

Advant[®] OCS
with Master software

Advant[®] Controller 160

Version 1.2

Product Guide

3BSE 014 721R101



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Chapter 1 Overview

1.1 Introduction

Advant Controller 160 is a highly modular controller used within Advant OCS system for general applications which require high availability and redundancy.

It is offering a full complement of control and communication functions and meets high requirements concerning performance, reliability and safety for burner management, safety systems, turbine control etc. through redundancy for all central components.

Advant Controller 160 is designed to work stand alone as well as an integrated part of the Advant OCS system to suit a wide range of applications.

The following key words summarize the philosophy of the system:

- Integration
- Distribution
- Reliability
- Openness
- User Friendliness
- Investment Security and Expandability

Figure 1-1 shows an example of a system configuration with Advant Controller 160.

One example of an Advant OCS system configuration including Advant Controller 160 is shown in Figure 1-2.

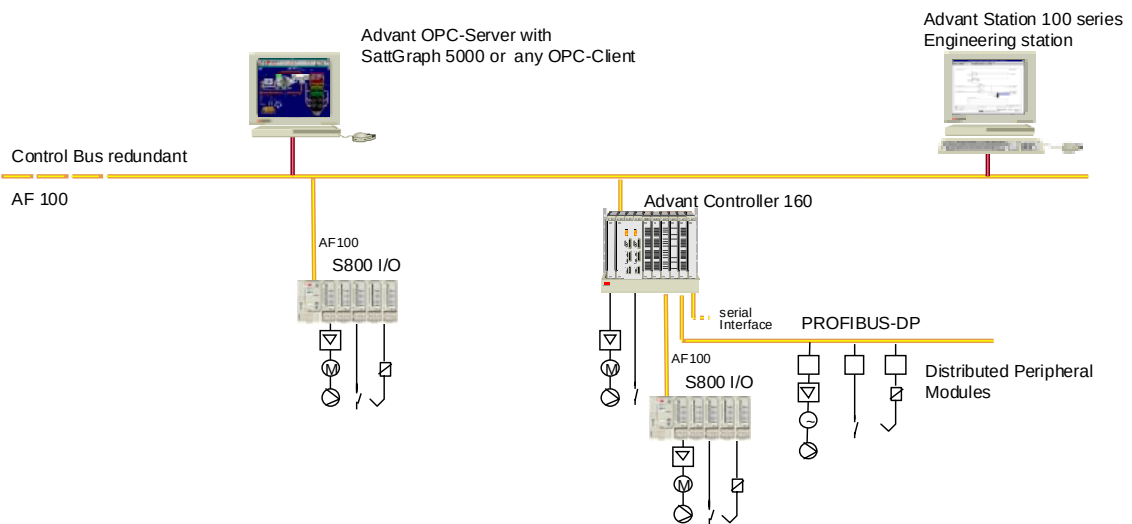


Figure 1-1. Typical System layout, for Protection Applications

1.2 Features

1.2.1 General

Advant Controller 160 offers powerful features covering all aspects of process control. The following are examples of control functions provided by the system:

- Logic and sequence control
- Regulatory control
- Supervisory control
- Positioning
- Calculations and process optimization
- Recording of alarms and events
- Process interfacing
- Open interface to alien systems via standard via serial interfaces, such as Modbus and Siemens 3964R
- Password protection for application
- Password protection for Engineering Station access to the controller

1.2.2 Performance, Reliability and Safety

Advant Controller 160 meets high requirements concerning performance, reliability and safety for burner management, safety systems and turbine control through

- multiprocessing
- redundancy for all central components
- multi-channel controller configurations

1.2.3 Process Interface

Advant Controller 160 communicates with the process through various types of sensors and actuators connected to process interface units, or input/output (I/O) units. Interfacing is available for the following signal types:

- Analog Inputs
 - Isolated and non-isolated inputs. Standard voltage (0 – 10 V, 0 – ± 20 mA), Pt 100 and thermocouple inputs.
- Analog Outputs
 - Isolated standard voltage or current outputs.

- Digital Inputs
 - Isolated and non-isolated 24 – 60 V d.c., 24 – 250 V a.c./d.c, with SOE capabilities.
- Digital Output
 - Isolated and non-isolated 24 – 60 V d.c., 24 – 250 V a.c./d.c., transistor and relay outputs.
- Pulse Counters
 - Isolated, 5 V, 24 V d.c. or ± 13 mA, max 100 kHz.

1.2.4 Operator interfaces

1.2.4.1 SattGraph 5000 Operator Station with Advant OPC Server

SattGraph 5000 is an ABB SCADA (Supervisory Control and Data Acquisition) system based on Windows NT 4.0.

For interaction between operator and process it provides an HMI (Human Machine Interface), based on process graphics including information zooming, multiple windows and handling for control operations, events, alarms and historical value recording.

SattGraph 5000 and Advant Controller 160 communicate via OPC Server for Advant Fieldbus 100. This software is an ABB product that provides a standard OPC interface to connect any OPC Client (also third party products) to Advant Fieldbus 100 and thus establishes access to Advant Controller 160.

1.2.4.2 AdvaSoft 2.0 for Windows NT with Advant OPC Server

AdvaSoft 2.0 for Windows NT is an Operator Station based on Windows NT 4.0.

For interaction between operator and process it provides an HMI (Human Machine Interface), based on process graphics including information zooming, multiple windows and handling for control operations, events, alarms and historical value recording.

Advasoft 2.0 and Advant Controller 160 communicate via OPC Server for Advant Fieldbus 100. This software is an ABB product that provides a standard OPC interface to connect any OPC Client (also third party products) to Advant Fieldbus 100 and thus establishes access to Advant Controller 160.

1.2.4.3 Advant Station 500 Operator Station

Within Advant Station 500 Operator Station (AS 500OS) all process objects are operated by dynamic function keys which pop up by just clicking on the symbol of the object, e.g., a pump, in the process display. Additionally to the buttons for process operation these keys provide a wide range of functions as acknowledgement, alarm blocking, limit and parameter setting, etc.

AS 500OS supports binary history and archiving as well as retrieval.

1.2.5 Engineering

1.2.5.1 Advant Station 100 Series Engineering Station

Advant Station 100 Series Engineering Station (AS 100ES) is a ready to use system and includes everything necessary for configuration and programming of Advant Controllers.

AS 100ES is an PC-based programming and service tool that supports program entry, testing, documentation and fault tracing. It features graphical function chart programming and a user interface with windows, pull-down menus and “point and click” selection.

Chapter 2 Software Functions

2.1 Process Control Software

Process control applications are programmed in the ABB Master Programming Language (AMPL). The building blocks of AMPL are called PC elements which covers a wide range of functions.

The Engineering Stations support type circuits; standard solutions to control problems in an application area or in a specific application project. A type circuit may comprise all the functions to control motors, pumps, valves, temperature loops, etc., including all the necessary definitions for I/O and operator communication. It can be tested and corrected before it is multiplied. This means optimization of engineering work by using standard solutions.

2.1.1 AMPL

AMPL is a function-block language with graphic representation, which is especially oriented towards process control. The function blocks offer a high level of configurability from simple to complex. The language is common for all controller products within Advant Power System and Advant OCS.

The general description is given within the Advant OCS Product Guide with the same chapter number.

2.1.1.1 PC Elements for Advant Controller 160

For Advant Controller 160 a comprehensive library of PC elements is available ([Table 2-1](#)).

Table 2-1. PC elements for Advant Controller 160 - overview

Type	PC element
Structure elements	PCPGM, CONTRM, FUNCNM, MASTER, SLAVEM, BLOCK, SEQ ⁽¹⁾ , STEP ⁽¹⁾ , GRC, P_STEP
Logic	AND, OR, XOR, INV, AND-TRG, OR-TRG, ADD-MR, TRESH-L, SR, SR-D, SR-AA, SR-AO, SR-OA, SR-OO, AND-O, OR-A, BGET, BSET
Arithmetic	ADD, SUB, MUL, DIV, ABS, SQRT, LIM-N, ADD-MR, DIV-MR, MULDIV
Time	MONO, MONO-UT, TON, TOFF, TON-RET, TRIGG, OSC-B, TIMER
Registers	FIFO, MOVE, REG, REG-G, REG-G-UT, SHIFT
Multiplexers	MUX-I, MUX-MI, MUX-MN
Code converters	CONV, CONV-BI, CONV-IB

Table 2-1. PC elements for Advant Controller 160 - overview (Continued)

Type	PC element
Counters	COUNT
Comparators	COMP-B, COMP-I, COMP-R, COMP-B, MAX, MIN
Switches	SW, SW-C
Measurement elements	RSM ⁽²⁾
Signal Selector	MOON
Function generator	FUNG-1V
Filter	FILT-1P
Regulatory control	P-1, INT, DER, PI, PIP, PDP, CON-PU1, RAMP
Redundancy	MOVED, TRAC, SW-RED, RED_STAT
MasterFieldbus	COM-CVI1, COM-CVO1, MBF-IN, MBF-OUT
PROFIBUS	PB-IN, PB-OUT
Protection and Safety	PC_AX646, CONV-AX, PC_DX610, SYS-CRC
Supervision	SYSL, SYSTIME

- (1) SEQ and STEP cannot be used with redundant processing (CPU or station redundancy).
Instead GRC and P_STEP can be used.
- (2) RSM cannot be used with PM 646

Chapter 3 Hardware Functions

3.1 Controller Hardware

The hardware of Advant Controller 160 consists of Processor Modules, Communication Interface modules, Submodule Carrier, I/O modules with process connectors, subracks, cable ducts and power supplies.

Subracks and cable duct are designed for wall mounting or mounting in cabinets. Normally they are mounted in cabinets.

The modules are housed in a sheet-steel enclosure which protects the circuit boards. The enclosure has openings at the top and bottom for air convection. It meets the IP20 protection class of IEC 529.

3.1.1 Processor Modules

Six different types of Processor Modules are available for Advant Controller 160:

- Processor Module for non redundant processing PM640.
- Processor Module PM644 for non redundant processing with PROFIBUS-DP master interface on the Processor Module.
- Processor Module for redundant processing PM645A.
- Processor Module PM645B for redundant processing with rotational speed signal input on the Processor Module.
- Processor Module PM645C for parallel processing with data exchange via high-speed-link on the Processor Modules and with rotational speed signal input on the Processor Module.
- Processor Module PM646 for redundant processing with additional hardware and software monitoring functions required for safety application systems.

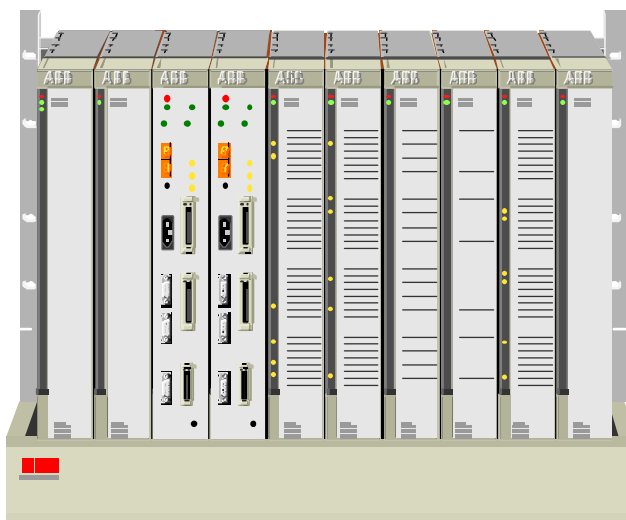


Figure 3-1. Advant Controller 160, controller subrack

Processor Module PM640

The Process Module PM640 got the following features:

- The Processor Module PM640 contains a Motorola MC68360 processor, 1 MByte nonvolatile memory (Flash PROM) for user built applications and 2 Mbyte nonvolatile memory (Flash PROM) for the system software, and 2 MBytes SRAM. At start-up the application is copied from the nonvolatile memory into the SRAM memory where it is executed. The memory is not expandable.
- PM640 contains two RS232-C ports dedicated for connection of an Advant Station 100 Series Engineering Station and for connecting a local Operator Station via Modbus I protocol.

Processor Module PM644

The Processor Module PM644 has all features of PM640 as described above plus the following ones:

- The Processor Module PM644 contains a second Motorola MC68360 processor with extra 2 MByte nonvolatile memory (Flash PROM) for the system software and extra 2.25 MByte SRAM for PROFIBUS communication.
- The Processor Module PM644 contains a PROFIBUS-DP master interface with RS485 port for data exchange with PROFIBUS slaves.
- The PM644 additionally contains two rotational speed signal input ports of type RS422.

Processor Modules PM645A, PM645B, PM645C

The Processor Modules PM645A/B/C have all features of PM640 as described above and in addition the following ones:

- All Processor Modules PM645 contain a second Motorola MC68360 processor with extra 512 kbyte nonvolatile memory (Flash PROM) for the system software and extra 2 MByte SRAM.
- All Processor Modules PM645 contain two RS422 ports (high-speed-serial-links) for signal and data exchange between Processor Modules for application and system purposes.
- The Processor Modules PM645 type A and B additionally contain a redundancy voter for dual and triple redundancy.
- The PM645 types B and C additionally contain two rotational speed signal input ports RS422.
- Processor Module PM645B additionally contains 2 DI and 3 DO.
- Processor Module PM645C additionally contains 8 DI and 8 DO.

Processor Module PM646

The Processor Module PM646 has all features of a PM640 as described above and in addition the following ones:

- PM646 contains a second Motorola MC68360 processor with extra 2 MByte nonvolatile memory (Flash PROM) for the system software and 2 MByte SRAM.
- The 2 MBytes SRAM is extended with a secondary 2 MBytes SRAM (Mirror-RAM) for a redundant data storage with a hardware-based data comparison.
- The Processor Module PM646 contains two RS422 ports (high-speed-serial-links) for signal and data exchange between Processor Modules for application and system purposes.
- The Processor Module PM646 additionally contains a redundancy voter for dual and triple redundancy.
- Both printed circuit boards of PM646 contain a watchdog circuit with outputs combined for triggering the on-board relay (Implementation of an independent “Second Shutdown Path” for safety systems).
- The PM646 has an extended 5 V power supply supervision with under- and overvoltage detection.

3.1.2 Interface module carriers

The purpose of the submodule carrier is to carry communication interfaces. Each Advant Controller 160 can accommodate one SC610 submodule carrier module.

Note that an SC610 can only be operated with a PM640, PM644 or a non redundant PM645, PM646 or with a PM645A or B, PM646 in station redundancy.

Table 3-1. Submodule carrier

Consists of	Description
SC610	Submodule Carrier, required for connection of CI532. Two submodules fit into one carrier; one SC610 per controller.

3.1.3 Communication Interfaces

Communication interfaces are realized as modules or submodules. A submodule is a small board which fits into a slot on the submodule carrier, SC610. Modules can be exchanged while the system is running. New modules can also be inserted live. Every unit has a red LED to indicate fault.

Table 3-2. Communication interfaces

Consists of	Description
CI532V01	RCOM/RCOM+ communication. Each interface holds two buses.
CI532V02	MODBUS communication. Each interface holds two buses.
CI532V03	Siemens 3964(R) communication. Each interface holds two buses.
CI626	Advant Fieldbus 100, coaxial cable.
CI627	Advant Fieldbus 100, twisted pair cable.
CI630	Advant Fieldbus 100, coaxial cable, redundant coupling with 2 interface modules.
CI631	Advant Fieldbus 100, twisted pair cable, redundant coupling with 2 interface modules.

3.1.4 Subrack

The 10-position controller subrack, RF616, is the primary subrack of an Advant Controller 160. It provides dedicated positions for Processor Modules, communication and bus extender modules.

There is a two-digit thumbwheel switch for setting the station address. The individual module address is given by its position in the subrack.

The bus connector links the controller subrack to an optional extension subrack via a bus cable (TK612).

The 10-position extension subrack, RF620, extends the number of I/O modules of a station.
The individual module address is given by its position in the subrack.

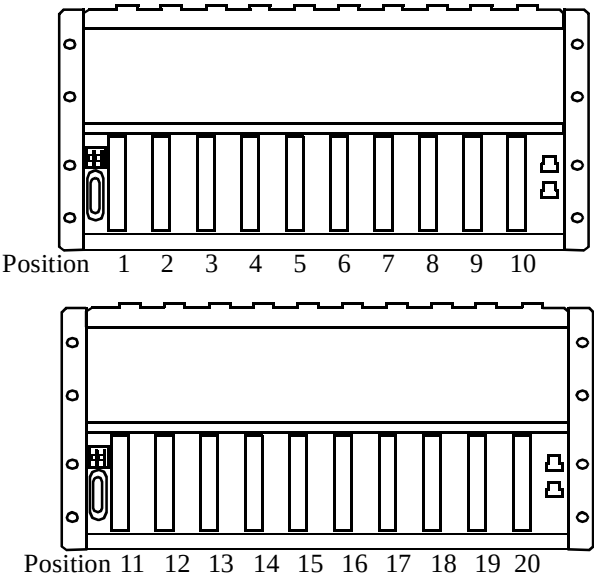


Figure 3-2. Basic subrack RF616 and Extension subrack RF620

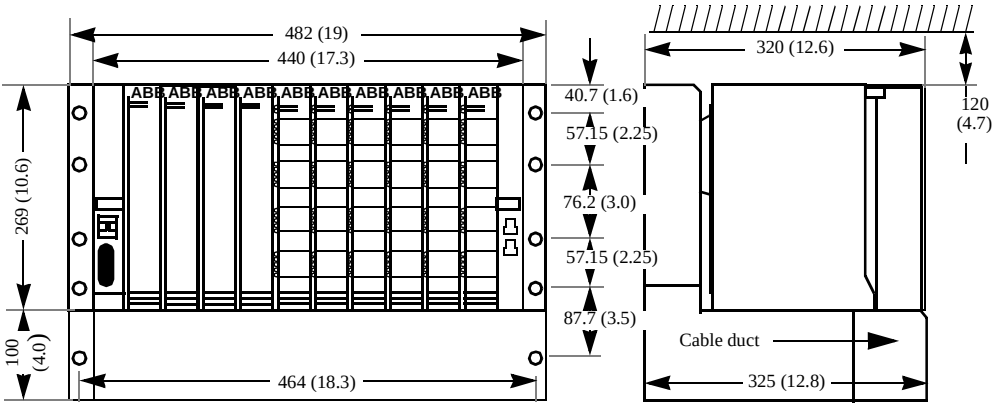


Figure 3-3. Physical layout of subrack and cable duct

3.1.5 Cable Duct

The cable duct RC610 holds the process cables. It also provides 10 screw terminals for connecting the cable shields of process cables to ground.

3.1.6 Power Supply

Advant Controller 160 can be connected to the following types of primary supply:

- 120 V or 230 V a.c., 47 to 450 Hz, using the power supply module SA610.
- 110 V/125 V or 220 V/250 V d.c., using the power supply module SA610.
- 24 V d.c., direct supply to Advant Controller 160 from an external power supply.

The electronic circuits of the modules are fed by means of two redundant power rails. The 0 V level is connected to the metallic part of the subrack.

Table 3-3. Station voltage specifications

Description	Value
Nominal voltage	24 V d.c.
Acceptable voltage range	19.2 – 30 V d.c.
EMI protection level	None (station voltage must be filtered)

The use of the power supply module SA610 is recommended. SA610 is housed in the standard module enclosure and occupies one position in the subrack. SA610 provides reinforced primary voltage isolation, excellent EMI filtering and buffering of short (10 ms for 110 V d.c. input and 20 ms for 230 V a.c. input) primary voltage drop out. If one SA610 is not sufficient, two can be used in parallel within one subrack, i.e. up to four modules SA610 within one station (basic station or I/O station).

Advant Controller 160 can be powered from an external 24 V d.c. power source (i.e. without SA610). Special attention must be paid to grounding and noise level. An EMI filter must be used, and the negative pole of the supply be grounded in the metallic part of the subrack.

All available power supply solutions are listed in the reference guide.

3.2 Input/Output Hardware

3.2.1 S600 Local I/O

The S600 I/O system consists of I/O modules with typically 16 or 32 input or output channels, depending on the type of module. The I/O modules are placed in I/O stations which are built up by one or two I/O subracks. I/O modules can also be inserted into the controller subrack.

The general description of the I/O system is given within the Advant OCS Product Guide with the same chapter number.

The following chapter contains specific information for Advant Controller 160.

3.2.1.1 I/O Station with Redundant Bus Extension

For Advant Controller 160 the I/O bus extension can be configured for redundancy with two CI615 interface modules and two extension bus lines. This configuration provides increased system reliability compared to non redundant I/O bus extension.

Note that due to design reasons a switch-over between two CI615 in a redundant configuration may take up to one second.

Each I/O station connected to both extension bus lines contains two bus extenders, CI610, which must be put in position 1 and 2.

Table 3-4. Bus extender modules

Consists of	Description
CI610	Bus extender module for I/O station
CI615	Bus extender module for Basic Station

The maximum bus cable length of each bus line is 20 m (65 ft.).

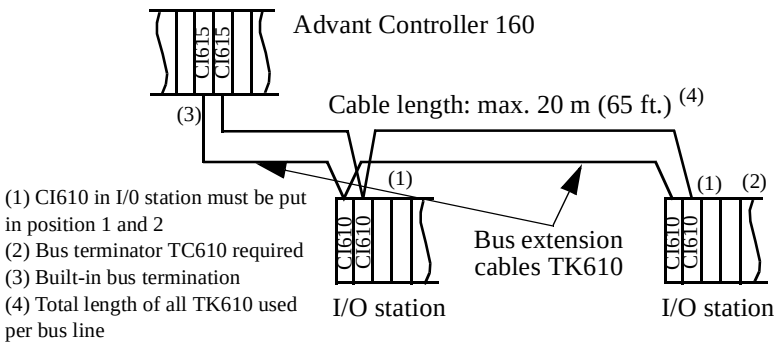


Figure 3-4. Configuration of I/O stations for AC 160 with redundant bus extension

The I/O stations may be mounted in the same or in adjacent cabinets. The stations must be connected to a common ground; the voltage difference at the ground terminals must be less than ± 2 volts.

The bus extension cable TK610 can be delivered in lengths of 2.5, 5 and 10 m (6.6, 16.4 and 32.8 ft.). The above figure shows the configuration with redundant bus extension.

The table below specifies the equipment used to build up I/O stations with redundant bus extensions.

Table 3-5. I/O units with redundant bus extension

Units	Description
Subrack RF615, Cable duct RC610 and two Bus extenders CI610.	I/O station with redundant bus extender.
Subrack RF620, Cable duct RC610, Bus cable TK612 and Power cable TK615.	I/O extension kit.
2× (Bus extenders CI615 for base station and Bus terminators TC610 for I/O extension bus).	2× I/O bus extension kit.
RC620	I/O Fan unit 24 V.

3.2.2 S800 Distributed I/O

The S800 I/O is a distributed I/O for Advant Controller 110, Advant Controller 160, and Advant Controller 450 via Advant Fieldbus 100. S800 I/O is also used as a directly connected I/O to Advant Controller 70.

The S800 I/O system consists of I/O modules with typically 4, 8 or 16 input or output channels, depending on the type of module.

The I/O station is connected to Advant Fieldbus 100 via a redundant or non redundant Fieldbus Communication Interface (FCI).

The S800 I/O Hardware User's Guide gives more details about these modules. The S800 I/O Product Guide gives a first overview.

The following S800 I/O modules are supported:

Table 3-6. S800 I/O modules supported by Advant Controller 160

Module type	Type designation
CI	CI810, CI820
AI	AI810, AI820, AI830, AI835
AO	AO810, AO820
DI	DI810, DI811, DI814, DI820, DI821, DI885
DO	DO810, DO814, DO815, DO820, DO821

3.3 Communication Hardware

3.3.1 Field Communication Hardware

3.3.1.1 Advant Fieldbus 100

Advant Fieldbus 100 (AF 100) is a high performance fieldbus which is used for communication between Advant Controllers and Advant Stations.

The general description is given within the Advant OCS Product Guide with the same chapter number.

The following chapter contains specific information for Advant Controller 160.

Communication Interfaces for Advant Controller 160

With Advant Controller 160 the following Communication Interfaces and modems can be used:

- CI630, CI626 and CI626V1 for coaxial cable.
- TC630 for conversion between coaxial and optical cable.
- TC513 for conversion between coaxial and twisted pair.
- CI631, CI627 for twisted pair cable.
- TC514 for conversion between twisted pair and optical cable.
- TC515 for repeating twisted pair to twisted pair.

For increased availability, two CI630, CI631 can be used as redundant pairs.

NOTE

- If CI630 and/or CI626V1 and/or CI631 and/or CI627 are used, media redundancy is fully supported.
- If CI626 is used:
Coaxial media redundancy only is supported, with restrictions in cable length difference between the two redundant cables.
With optical bus cable, only one physical bus line is possible.

CI630, CI631 supervises if each Data Set to be sent via Advant Fieldbus 100 is cyclically updated by the Processor Modules. In case of missing update CI630, CI631 stops sending the respective Data Sets which is automatically detected by each receiving node.

Supported Configurations

Advant Controller 160 supports the following Advant Fieldbus 100 configurations:

- Communication with Advant Controller 70, 110, 160, 450, SattGraph 5000, and AdvaSoft 2.0 Operator Station with OPC Server (Figure 3-5 to Figure 3-7).
- Coaxial, twisted pair and optical bus cables (Figure 3-5 to Figure 3-7).
- Redundant bus cables (Figure 3-5 to Figure 3-7).
- Redundant Communication Interfaces to Advant Fieldbus 100 (Figure 3-5).
- Second subordinate Advant Fieldbus 100 with redundant Communication Interface for communication with S800 I/O stations and subordinate Advant Controller 70, 110 or 160 (Figure 3-7).

When redundant media are used, redundancy must be maintained through the whole bus; this comprises bus lines as well as connections of nodes to the bus.

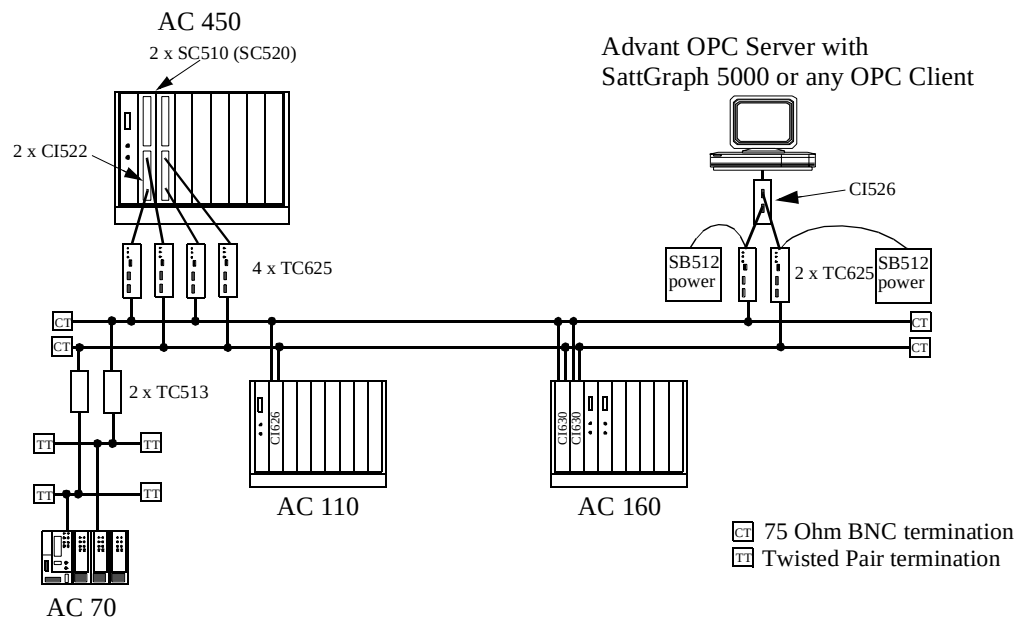


Figure 3-5. Redundant Advant Fieldbus 100 configuration using coaxial media

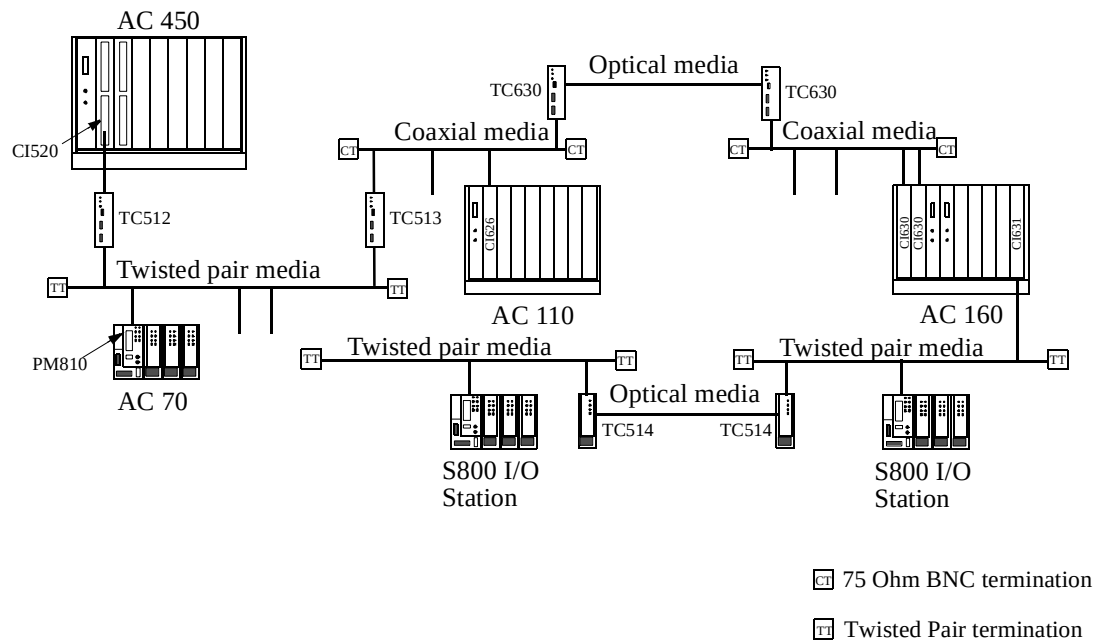


Figure 3-6. Media conversion in Advant Fieldbus 100

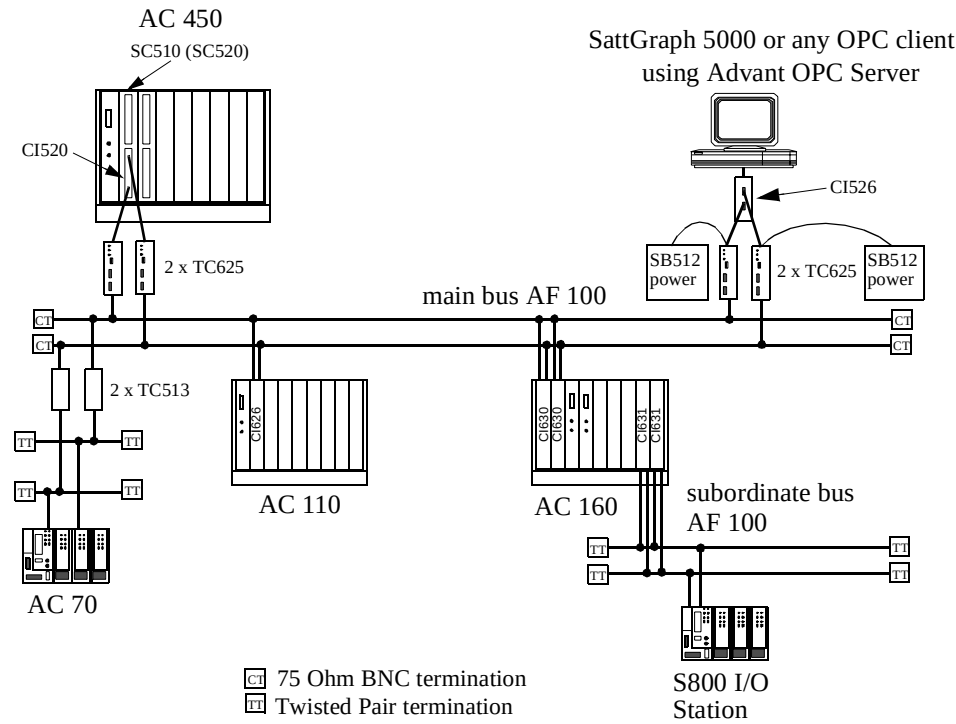


Figure 3-7. Dual Advant Fieldbus 100 configuration

3.3.1.2 PROFIBUS-DP

PROFIBUS is a high performance fieldbus which is used for communication between Advant Controllers and PROFIBUS slaves (PROFIBUS DPMs, **D**istributed **P**eripheral **M**odules). Therefore the PROFIBUS variation PROFIBUS-DP (**D**ecentralized **P**eriphery) is used.

The general description is given within the PROFIBUS norm EN 50170.

The following chapter contains specific information for Advant Controller 160.

Communication Interface for Advant Controller 160

With Advant Controller 160 the Processor Module PM644 is used as Communication Interface (PROFIBUS-DP master class 1) to PROFIBUS.

Supported Configuration

Advant Controller 160 supports the following PROFIBUS configuration:

- Communication with up to 125 PROFIBUS-DP slaves per PROFIBUS, via twisted pair bus cables according to EN 50170 (Figure 3-8).
- Up to 32 devices (master or DPMs or repeaters) per cable segment.
- Cable segment length up to 1,200 m.
- Up to 244/244 input/output bytes process data per PROFIBUS slave.
- Up to 236 input diagnostic data bytes per PROFIBUS slave.
- Transmission speed from 9,600 Baud up to 12 MBaud.
- Up to 6 Processor Modules PM644 can be used in an Advant Controller 160.
- It is recommended to use only certified PROFIBUS-DP slaves

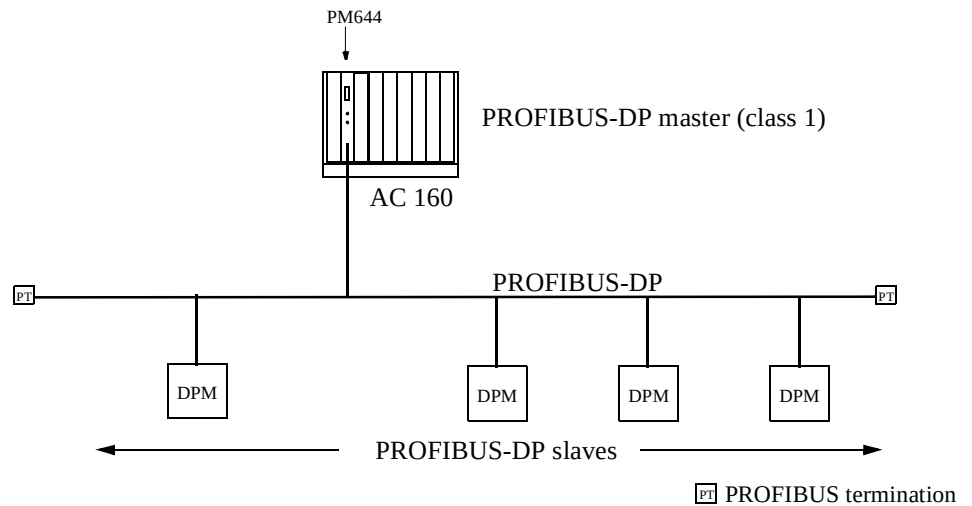


Figure 3-8. Sample PROFIBUS-DP configuration

Chapter 4 Advant Controller 160 Configurations

4.1 Configuration Overview

ABB's Advant Controller 160 is a high performance modular controller for logic and regulatory control with redundancy. Advant Controller 160 and its S600 local I/O or S800 distributed I/O can be used stand-alone or it can communicate with other controllers. Communication with Advant Controller 400 Series is possible via Advant Fieldbus 100 and RCOM. Communication with external PLCs is possible via Modbus and Siemens 3964R protocol.

The controller is specifically designed for high-speed PLC-type applications, but it also brings considerable problem-solving power to all analog signal handling and arithmetic applications.

Advant Controller 160 covers a wide range of applications. As programming language AMPL is used. The function element library contains a complete set of functions. Application programs can be shared between Advant Controller 55, Advant Controller 70, Advant Controller 110, Advant Controller 160, and Advant Controller 400 Series, provided that a common set of AMPL elements is used.

Program entry, testing, documentation and fault tracing are supported by the Advant Station 100 Series Engineering Stations. These stations feature graphical Windows based function-chart programming and a user interface with multiple windows, pull down menus and "point-and-click" selection. Advant Controller 160 communicates with the engineering station through its standard serial interface or via Advant Fieldbus 100.

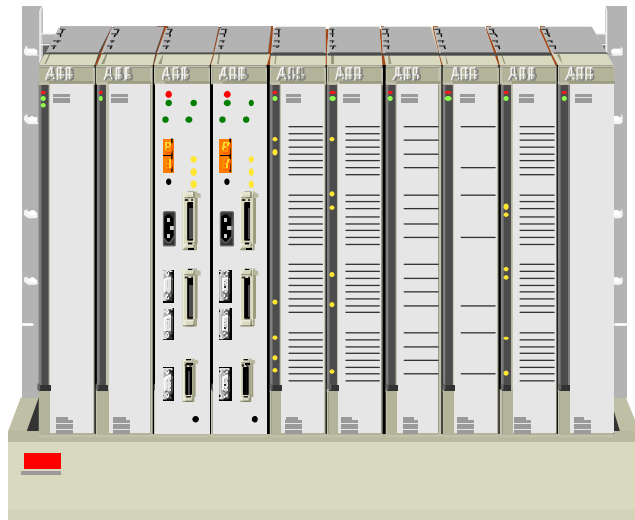


Figure 4-1. Advant Controller 160 – Basic Unit

Advant Controller 160 is fully modular, with modules mounted in 19" subracks. The subracks are designed for mounting on the rear wall in a cabinet.

A minimal Advant Controller 160 configuration consists of one or two subracks containing the two redundant Processor Modules and up to 18 I/O and communication modules.

In order to extend the number of I/O modules, up to 7 I/O stations may be connected to the basic station, each consisting of up to two subracks.

To increase the numbers of I/Os, it is also possible to connect decentralized S800 I/O (subordinated Advant Fieldbus 100 via CI627/CI631) and decentralized PROFIBUS-DP I/O (PROFIBUS-DP via PM644), to the Advant Controller 160.

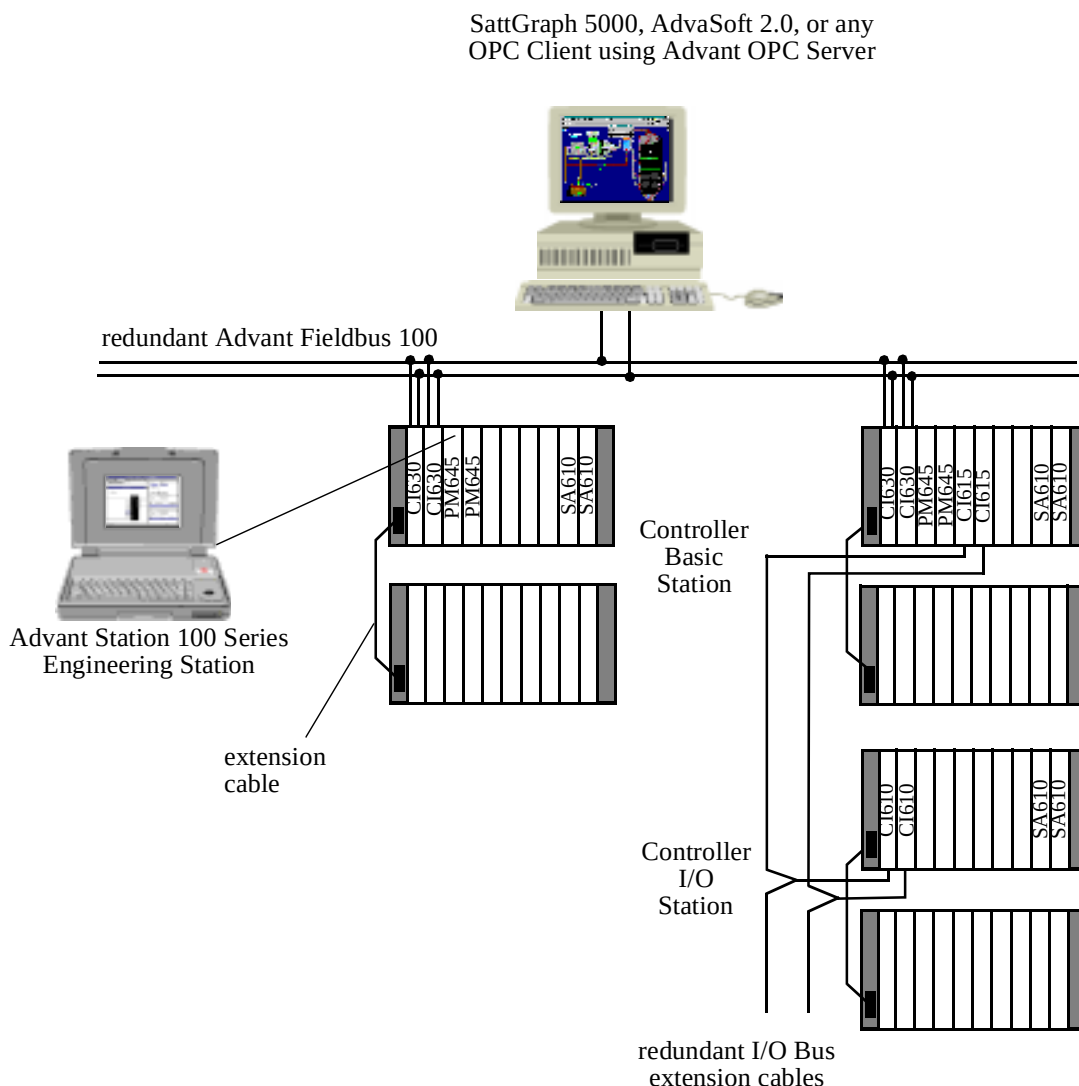


Figure 4-2. Advant Controller 160 System Structure, Redundant Configuration

For connection of a local operator station (3rd party product), the Processor Module of Advant Controller 160 is equipped with a MODBUS I serial interface.

SattGraph 5000 or AdvaSoft 2.0 for Windows NT Operator Stations using Advant OPC Server are easily connected via Advant Fieldbus 100.

Using dual redundant Processor Modules, dual redundant communication interface modules to Advant Fieldbus 100 and to I/O extension bus, dual redundant power supply modules and mains supplies an increased availability of the Advant Controller 160 can be achieved.

Advant Controller 160 is fully modular with use of subracks for all modules. The subracks can be installed in cabinets or can be mounted directly on the wall. All process connections can be made to screw terminals on connections units.

4.2 Preconditions and Restrictions

For support of Advant Controller 160 AMPL Function Chart Builder must be upgraded to version 4.7.

4.3 Product Components

The functional extent of Advant Controller 160 is determined by adding optional software and hardware units to the Basic Unit. The software options are delivered as program modules and may be selected to create the desired functional configuration. Optional hardware units are additional Processor Modules, I/O and communication modules, etc.

4.3.1 Software Components

The software system for Advant Controller 160 is built around one basic program module to which optional program modules can be added. The optional program modules can be combined in any combination that is needed to solve the application task. In contrast to Advant Controller 110 the basic program module for Advant Controller 160 already contains the program modules OPT2 and OPT3, whereas OPT1, OPT4, and OPT6 are separate software options. The basic program module additionally contains Advant Controller 160 specific DB elements. Otherwise the program modules are identical to those of Advant Controller 110. A description of the program modules and a specification of their contents is given below.

4.3.1.1 Basic Program Module

The contents of the PC element library in the basic program module is shown in [Table 4-1](#). The PC element MOVERED is used for planned recursions and for operator commands within application programs of redundant Processor Modules PM645A or PM646.

Table 4-1. PC Elements in BASE Program Module

Type	PC elements
Structure elements	PCPGM, CONTRM, FUNCN, MASTER, SLAVEM, BLOCK, SEQ ⁽¹⁾ , STEP ⁽¹⁾ , GRC, P_STEP
Logic	AND, OR, XOR, INV, AND-TRG, OR-TRG, ADD-MR, TRESH-L, SR, SR-D, SR-AA, SR-AO, SR-OA, SR-OO, AND-O, OR-A, BGET, BSET
Arithmetic	ADD, SUB, MUL, DIV, ABS, SQRT, LIM-N, DIV-MR, MULDIV

Table 4-1. PC Elements in BASE Program Module (Continued)

Type	PC elements
Time	MONO, MONO-UT, TON, TOFF, TON-RET, TRIGG, OSC-B, TIMER
Registers	FIFO, MOVE, REG, SHIFT
Multiplexers	MUX-I, MUX-MI, MUX-MN
Code converters	CONV, CONV-BI, CONV-IB
Counters	COUNT
Comparators	COMP-I, COMP-R, COMP-B, MAX, MIN
Switches	SW, SW-C
Redundancy	MOVERED, RED-STAT
MasterFieldbus	COM-CVI1, COM-CVO1, MBF-IN, MBF-OUT
PROFIBUS	PB-IN, PB-OUT
Protection	PC_AX646, CONV-AX, PC_DX610, SYS-CRC
Supervision	SYSL, SYSTIME

- (1) SEQ and STEP cannot be used with redundant processing (CPU or station redundancy). Instead GRC and P_STEP can be used.

NOTE

Additionally the basic program module of Advant Controller 160 already contains the program modules OPT2 and OPT3 (see respective paragraphs below).

4.3.1.2 Optional Program Module OPT1, Extended PC Elements

The optional program module OPT1, Extended PC Elements extends the PC element library that is included in the basic program module with PC elements for supporting the function:

- Regulatory control

Regulatory control is realized with PC elements. The contents of PC elements in OPT1 are shown in [Table 4-3](#).

Table 4-2. Additional PC elements in OPT1 Program Module

Type	PC element
Registers	REG-G, REG-G-UT
Function generator	FUNG-1V

Table 4-2. Additional PC elements in OPT1 Program Module

Type	PC element
Filter	FILT-1P
Feedback	P-1, INT, DER, PI, PIP, PDP, CON-PU1, RAMP

4.3.1.3 Program Module OPT2, MVI Handling

In conjunction with the MVI module CI532V01, V02 or V03, the optional program module OPT2, MVI Handling extends the functionality of the controller with the following communication facilities.

1. RCOM/RCOM+
2. Siemens 3964(R)
3. MODBUS

NOTE

- Use only one channel on the CI532Vxx board in slave mode.
- The program module OPT2 is already included within the basic program module of Advant Controller 160.

4.3.1.4 Program Module OPT3, Event Handling

Optional program module OPT3, Event Handling extends the functionality of the controller with event handling according to the following:

- Detection of events from digital or analog output terminals (calculated events)
- Handling of events from modules DI650, DI651, DI652, DI685, and DI885
- Event handling and event transfer via Advant Fieldbus 100
- Event handling via RCOM/RCOM+ (requires also OPT2 software)
- Time tagging of events
- Transit of events

The program module OPT3 is already included within the basic program module of Advant Controller 160. Same contents as for Advant Controller 110.

4.3.1.5 Optional Program Module OPT4, MODBUS I

The Optional program module OPT4, MODBUS I extends the functionality of the controller with the MODBUS I protocol (RTU, binary mode), which is intended for communication with a PC based HMI package. Advant Controller 160 can be used **only as a slave** on MODBUS. The separate serial interface on the Processor Modules is used for this purpose.

The following MODBUS functions (read/write commands) are supported:

01 = Read coil status	06 = Load single register
02 = Read input status	07 = Read exception status
03 = Read holding register	08 = Diagnostic loop-back
04 = Read input register	15 = Force multiple coils
05 = Force single coil	16 = Load multiple registers

4.3.1.6 Optional Program Module OPT6, Station Red. + RSM

Optional program module OPT6 that extends the controller functionality to the following:

- Station redundancy
- Rotational speed measurement

The contents of the PC element library in OPT6 are shown in [Table 4-3](#).

Table 4-3. PC Elements in OPT6 Program Module

Type	PC elements
Measurement elements	RSM
Signal Selector	MOON
Redundancy	TRAC, SW-RED

4.3.2 Hardware components

4.3.2.1 Basic Unit

The Basic Units for an Advant Controller 160 consist of the units in accordance to [Table 4-4](#).

Table 4-4. Basic Units for Advant Controller 160

Units	Description
RF616	Subrack
1 × PM640, 1 × PM644, 1 × PM645A, 1 × PM645B, 1 × PM645C, 1 × PM646	Type of Processor Module according to the desired Advant Controller 160 functionality.
RC610	Cable duct.
BASE incl. OPT2 and 3 ⁽¹⁾	Basic system software incl. program modules 2 and 3.

(1) for PM640, PM644, PM645A, PM645B, PM645C, PM646

The basic subrack of the controller may consist of one or two subracks.

In accordance to the desired Advant Controller 160 functionality the Basic Unit may be equipped with a minimum of one, or a various number of the available Processor Modules PM640, PM644, PM645A, PM645B, PM645C and PM646.

The following **rules** apply **for hardware configuration of the basic station of a controller**:

- The two subracks must be put in the same cabinet.
- The power supply terminals (USA, USB, ZD) of the two subracks must be linked. For EMI considerations, the subracks should be grounded with a 16 mm² copper lead.
- A minimum of one Processor Module for the Basic Unit is required.
- Up to six Processor Modules can be used within one Basic Unit.
- The Processor Modules must always be put in position 3...8 in the controller basic subrack
- At least one Communication Interface module CI626 or CI630 in position 2 is required within any Advant Controller 160 configuration even if no Advant Fieldbus 100 communication is required.
- The Communication Interface module for the main Advant Fieldbus 100 must be put in position 2 (non redundant interface), in position 1 and 2 (redundant interface) of the same subrack. Usable communication interfaces are CI630 for non redundant or redundant interface, CI626 for non redundant interface only.
- The Communication Interface module for the subordinate Advant Fieldbus 100 must be put in position 9 or 10 (non redundant interface), in position 9 and 10 (redundant interface) of the same subrack. Usable communication interfaces are CI630 or CI631 for non redundant or redundant interface, CI626 or CI627 for non redundant interface only.

- One Submodule Carrier module per controller is supported. SC610 is not supported by dual redundant Processor Module (CPU redundancy). SC610 requires one Processor Module PM640 or PM644 or PM645C or PM646 or one Processor Module PM645A/B or PM646 within station redundancy.
- If I/O stations are connected, the bus extender modules CI615 can be put in position 3...10 of the basic subrack.
- Up to two optional power supply modules SA610 per subrack can be put in position 9 and 10 (basic subrack) and 19 and 20 (extension subrack).

All modules can be replaced during system operation.

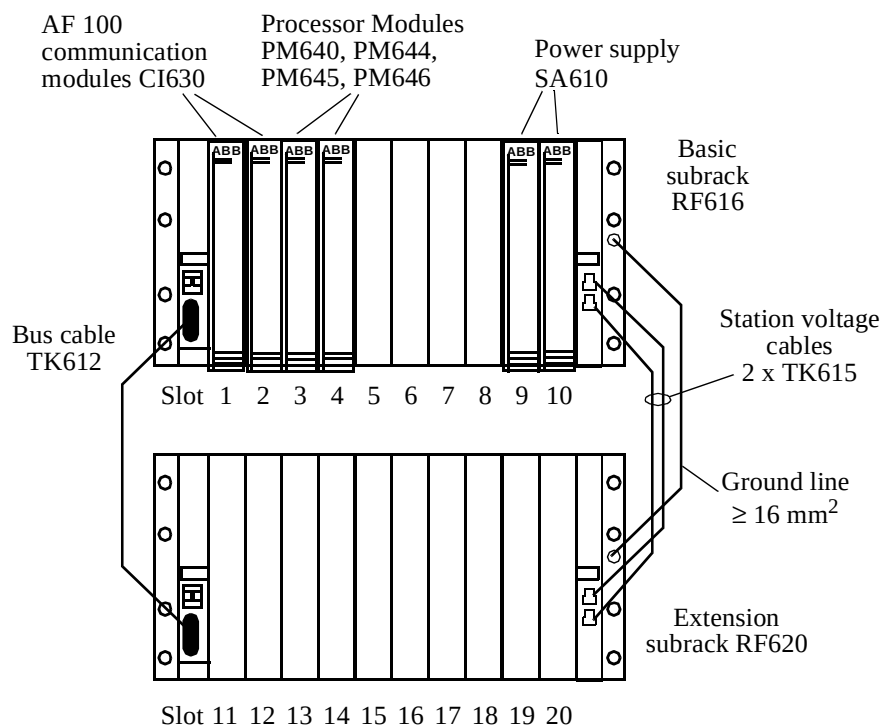


Figure 4-3. Advant Controller 160 with two Processor Modules, two Redundant CI630 Modules and two SA610 Power Supply Modules

For the typical Advant Controller 160 applications the following Basic Unit controller configurations are essential:

- **Basic Unit with one Processor Module PM640** for non redundant processing
- **Basic Unit with one Processor Module PM644** for non redundant processing with on-board PROFIBUS-DP (master class 1) interface and on-board rotational speed signal input (e.g. for turbine control)
- **Basic Unit with one Processor Module PM645A or PM646** for dual or triple redundant processing with on-board redundancy voter.
 - For dual redundancy an additional Processor Module PM645A or PM646 within the same station or in another station is necessary.
 - For triple redundancy two additional Processor Modules PM645A or PM646 within different stations are necessary.
- **Basic Unit with one Processor Module PM645B** for dual or triple redundant processing with on-board redundancy voter and on-board rotational speed signal input (e.g. for turbine control)
 - For dual redundancy an additional Processor Module PM645B within the same station or in another station is necessary
 - For triple redundancy two additional Processor Modules PM645B within different stations are necessary
- **Basic Unit with one Processor Module PM645C** for dual or triple parallel processing with on-board rotational speed signal input
 - For dual parallel processing an additional Processor Module PM645C within the same station or within different stations is necessary
 - For triple parallel processing two additional Processor Modules PM645C within different stations are necessary

4.3.2.2 I/O systems

For Advant Controller 160 the S600 local I/O and the S800 distributed I/O systems are used. The maximum number of I/O signals for an Advant Controller 160 is 1500. The actual CPU load depends on the configured cycle times for the application program.

S600 I/O system

A range of I/O modules is available, covering analog and digital signals of various types. In addition, there are modules for temperature measurement, pulse counting, position measurement and rotational speed measurement applications. The process signals are connected to the front of the I/O modules.

The controller may contain up to 75 I/O modules. All I/O modules may be exchanged during system operation. The process signals are disconnected by removing the front connector. A newly inserted module is automatically put into operation if the system identifies the module as being of the correct type and without faults. For further information about S600 I/O please refer to the S600 I/O section in the Input/Output Hardware section.

The *S600 I/O Hardware Reference Guide* and the *S600 I/O Hardware Advant Controller 160 Reference Guide* detail the various I/O modules available for Advant Controller 160.

- **Unused supervised inputs**
Unused supervised analog inputs of the Advant Controller 160 must be terminated with external resistors in order to avoid respective error detection and signalling by the Processor Modules.
- **Output set as predetermined**
In case of a severe controller error the outputs can be set to predetermined values. This output set as predetermined guarantees integrity of the process in case of controller failures.
Output set as predetermined can be configured with use of the relay outputs of the Processor Modules which are switched over in case of a severe error. Both an open and a closed contact are provided per Processor Module. E.g. the relay outputs can be used to switch off the external voltage for digital outputs if the Processor Module which controls these outputs fails.

S800 I/O system

A range of I/O modules is available, covering analog and digital signals of various types. The I/O system can be mounted horizontally or vertically on standard DIN-mounting rails according to DIN EN50033–35×15. The process signals are connected via module termination units, which are acting as I/O module carrier.

An I/O station may have of up to 24 I/O modules. All I/O modules may be exchanged during system operation. A newly inserted module is automatically put into operation if the system identifies the module as being of the correct type and without faults.

The general description of the I/O system is given within the Advant OCS Product Guide.

- **Output set as predetermined**
In case of a severe module error, the outputs can be set to predetermined values. This output set as predetermined guarantees integrity of the process in case of failures.

4.3.2.3 Communication

For communication with other controllers, Operator Stations and Engineering Stations, Advant Controller 160 can be connected to Advant Fieldbus 100 using the Communication Interface module CI630. Two Communication Interfaces can be used for redundancy. Instead of a non redundant CI630 also CI626 can be used.

A second Advant Fieldbus 100 for communication with subordinate Advant Controllers 160 or Advant Controllers 70 or S800 I/O can be connected via two (redundant) communication interfaces CI630 or CI631 or via one (non redundant) communication interface CI626 or CI627 or CI630 or CI631.

Table 4-5. Number of buses connected to Advant Controller 160

Bus type	Max number buses		Max number communication interfaces	
RCOM/RCOM+, CI532V01	4	total 4	2	total 2
MODBUS I, CI532V02	4		2	
Siemens 3964 (R), CI532V03	4		2	
PROFIBUS-DP, PM644	6		6	
Advant Fieldbus 100, main bus	1		2 (redundancy)	
Advant Fieldbus 100, subordinate bus	1		2 (redundancy)	

NOTE

For performance reasons only one channel on the CI532Vxx can be used if the module acts as slave.

4.3.2.4 Configurations for Increased Availability and Safety

Advant Controller 160 offers a wide range of configuration options for control system applications with high requirements concerning availability and safety.

For **high availability**—depending on the requirements—a single or even a double fault must be tolerated by the control system. I.e. the configured functions e.g., the control functions of a turbine must run without any interruption in case of a fault.

For **safety** a single or even a double fault must not impede a needed trip of the plant (e.g. a boiler or a turbine). Additionally for high availability usually it is required that a single fault must not activate a trip.

Availability can be increased through redundancy. Advant Controller 160 offers module redundancy for all central system components (communication modules, Processor Modules, power supply modules). For redundant signal I/O multiple I/O modules within separate controllers can be used.

Safety can be increased through the use of multiple safety channels working in parallel.

In the following paragraphs the redundant and parallel configurations supported by Advant Controller 160 and its Processor Modules are shown.

For more detailed information refer to the *Advant Controller 160 Users Guide*.

Configurations for redundant processing

The Processor Modules PM645A, PM645B, and PM646 can be used for redundant processing within the following configurations:

- **Dual redundant Processor Module**
Two Processor Modules within one station and with common I/O modules, synchronization via high speed serial link ([Figure 4-4](#)).

NOTE

For CPU redundancy Processor Modules PM645, PM646 and Communication Interfaces CI630 must be used in order to avoid single point of failure even if no Advant Fieldbus 100 communication is required.

- **Dual redundant station**
Two Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange and synchronization via high speed serial link (configuration not shown, similar to triple redundant station).
- **Triple redundant station for closed loop control**
Three Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange and synchronization via high speed serial link. Usable for closed loop control including control logic ([Figure 4-5](#)).

Dependent on the specific configuration **additional HW modules and cables for redundancy** are needed¹:

- The redundant Processor Modules must be connected with one another via its high speed serial link interfaces. Therefore one connection cable set TK662 is to be used per connection.
- For configurations with redundant Processor Modules within different stations the output signals to be provided redundantly via separate output modules must be selected externally. Therefore the selector switches 89AU31 for analog signals and 89AL31 for binary signals and I/O interface cables GKW E 602 635 must be used.

For commissioning of redundant configurations the hand-held Redundancy Test Module 89RT01 is available. It can be used for CPU and station redundancy and is necessary for the commissioning of redundancy configurations where the signals to be exchanged for synchronization shall not be defined automatically but planned individually.

1. Refer to [Section 8.1 Price List Structure](#) and [Section 8.5 Discontinued Articles](#)

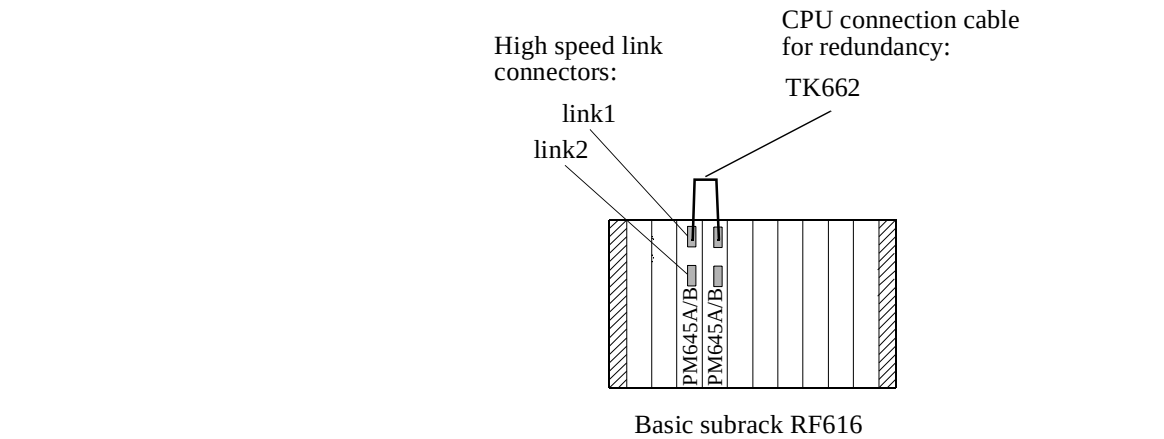


Figure 4-4. Dual redundant Processor Module within one Advant Controller 160

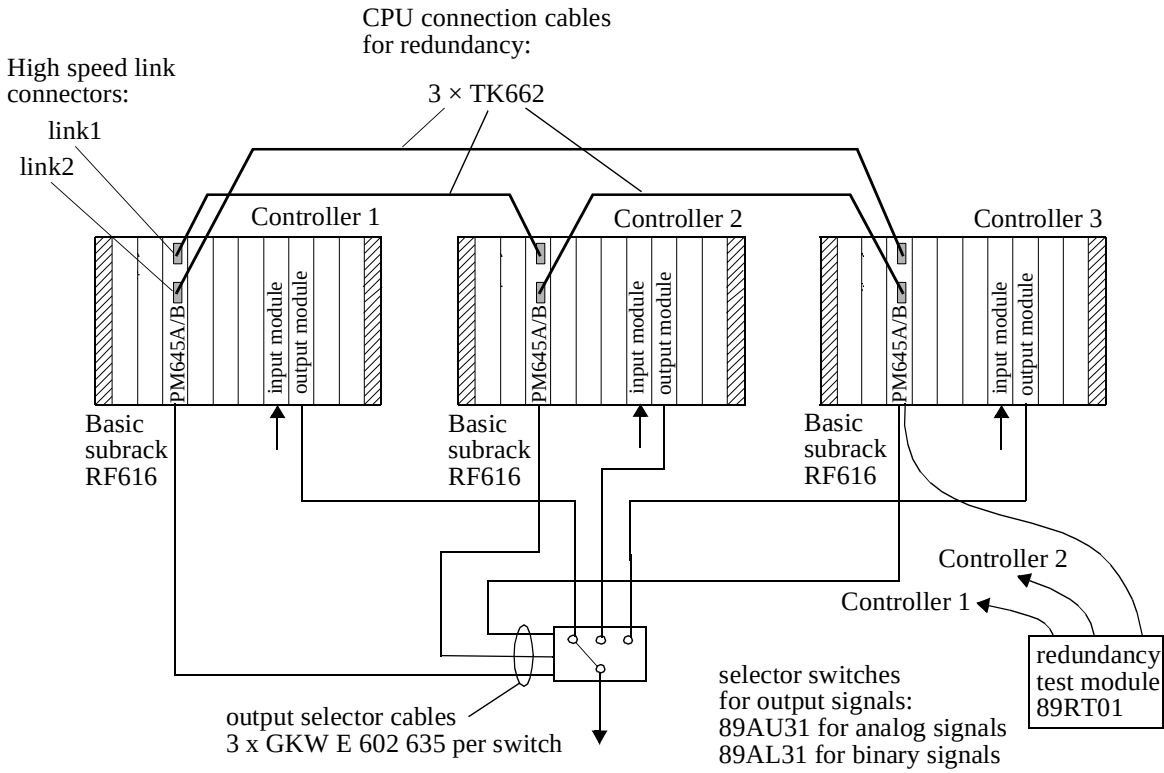


Figure 4-5. Triple redundant configuration with three (3) Advant Controller 160

Configurations for parallel processing with external voting

All Processor Modules PM640 or PM644 or PM645 or PM646 (PM64x) can be used for parallel processing with external voting if the Processor Modules are allocated within one common station:

- **Dual parallel Processor Module**
Two Processor Modules within one station with separate output modules and common set of input modules (Figure 4-6).
- **Triple parallel Processor Module**
Three Processor Modules within one station with separate output modules and common set of input modules (configuration not shown, similar to dual parallel Processor Module).

The Processor Modules PM645C or PM646 can be used for parallel processing with external voting if the Processor Modules are allocated within separate stations:

- **Dual parallel station**
Two Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange via high speed serial link (configuration not shown, similar to triple parallel station)
- **Triple parallel station**
Three Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange via high speed serial link (Figure 4-7)

Dependent on the specific configuration **additional HW modules and cables for parallel processing** are needed:

- The parallel Processor Modules within different stations must be connected with one another via its high speed serial link interfaces. Therefore one connection cable set TK661 is to be used per connection.
- For configurations with parallel Processor Modules the output signals to be provided via two respectively three separate output modules must be voted externally. Therefore specific voter devices must be used.

For Turbine Protection of ABB Turbines, three solenoid valves with electro hydraulic 2oo3 voting is the standard solution. If this solution doesn't apply the relay module 89AR30 can be used.

For Boiler Protection and other safety applications the relay module 89AR30 can be used too.

With the relay module 89AR30 configurations for 1oo2 (Figure 4-8) and 2oo3 voting (Figure 4-9) with de-energize to trip or with energize to trip are possible.

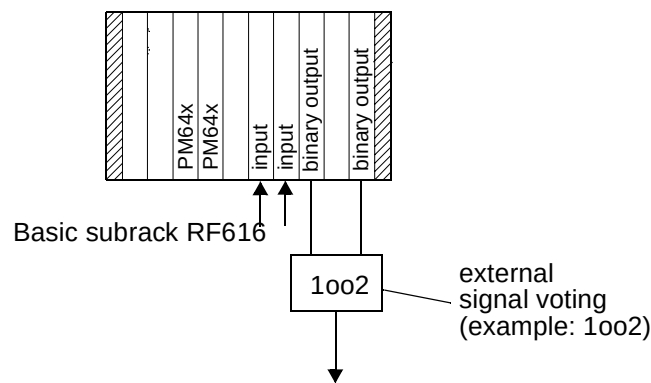


Figure 4-6. Dual parallel Processor Module within one Advant Controller 160

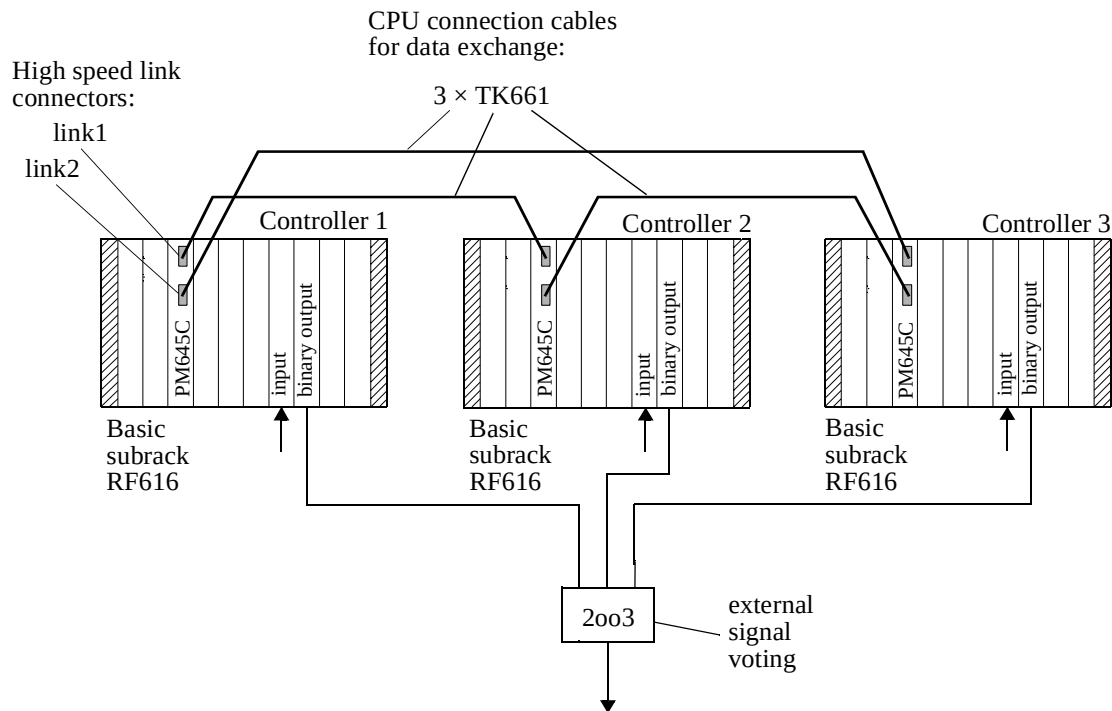


Figure 4-7. Triple parallel configuration with 3 Advant Controllers 160

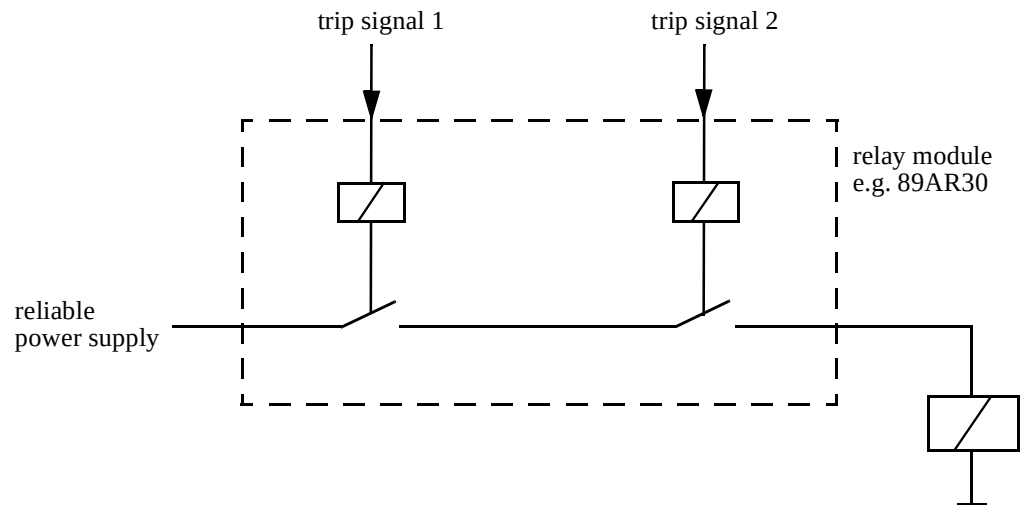


Figure 4-8. External signal voting: 1 out of 2 trip with use of a relay module

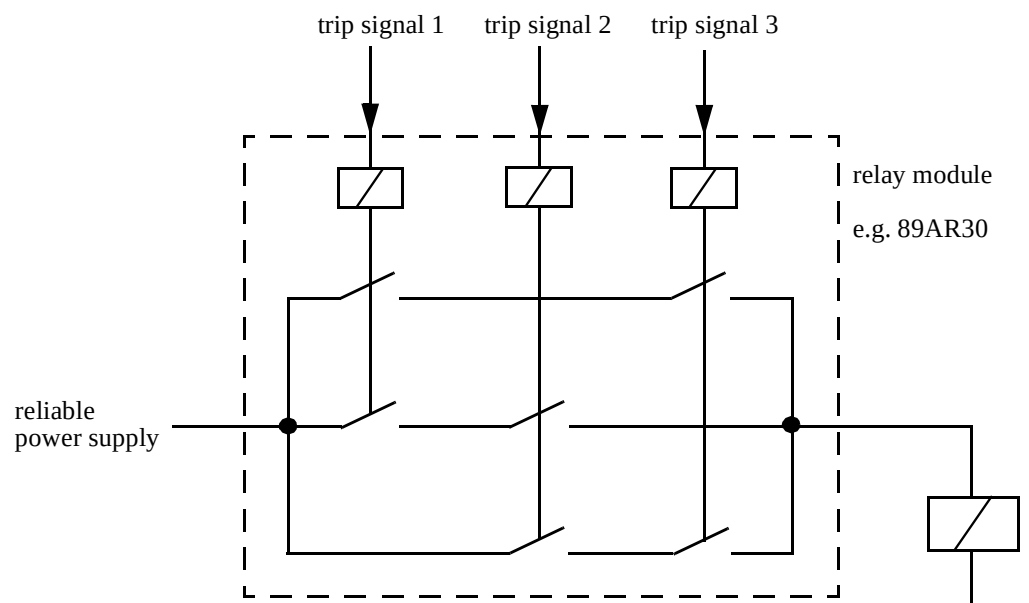


Figure 4-9. External Signal Voting: 2 out of 3 Trip with use of a Relay Module

4.3.2.5 System Clock Synchronization

Methods and System Components

Dependent on the specific system configuration using Advant Controller 160 different methods are available for synchronization of the system time:

- Time and date can be set via AS 100ES, AdvSoft for Windows and can be downloaded to Advant Controller 160 at the same Advant Fieldbus 100. Advant Controller 450 can be loaded from AS 100ES via front connector.
- Clock synchronization via Advant Fieldbus 100 can be done by a controller which is configured as time master through sending the actual time as broadcast message once a second via Advant Fieldbus 100. Any Advant Controller 450¹ or Advant Controller 160 but only one can be configured as time master. The other controllers and the stations are time slaves, receive the time sent and update its internal clocks.
- External clock synchronization with use of a minute pulse input is supported for Advant Controller 160 (with Processor Module PM645/PM646) and for Advant Controller 450. The minute pulse must be provided by a central clock, for example as output of a radio clock.
- In case of missing synchronization the internal clocks of the controllers and stations provide the actual time with reduced accuracy.

Table 4-6 gives an overview on the controllers usable as time master for synchronization via Advant Fieldbus 100 with its used methods and needed system components for system time input and synchronization.

Table 4-6. System Time Masters for Synchronization via AF 100

System time master	System time input and synchronization for the time master
Advant Controller 450	Manual setting of time and date via AS 100ES ⁽¹⁾ directly connected to AC 450 + External synchronization via minute pulse input of TC520
Advant Controller 160	Manual setting of time and date via AS 100ES, AdvSoft for Windows + External synchronization via minute pulse input of PM645, PM646

(1) With option online builder and engineering board

1. Advant Controller 450 can only be used as time master on Advant Fieldbus 100.

Configurations

Two typical configurations as normally used for control systems are:

- Autonomous control system with Advant Controller 160 and Operator Station AdvaSoft 2.0 for Windows NT.

Control system with several Advant Controller 160 and superordinate Advant Controller 450 and Operator Stations Advant Station 500OS.

Autonomous Control System with Advant Controller 160 and AdvaSoft

The configuration is shown in [Figure 4-10](#).

The Operator Station AdvaSoft 2.0 for Windows NT is time source, Advant Controller 160 on left is time master and can be synchronized via an external minute pulse. The other controllers are time slaves. The time master can contain a single Processor Module or dual or triple redundant Processor Modules or up to six Processor Modules for multiprocessing.

In case of redundant Processor Modules, the minute pulse is connected to each Processor Module. The active Processor Module is always the time master.

In case of single Processor Modules or station redundancy, the minute pulse is connected only to one Processor Module in one controller, which is the time master.

The time master sends time and date cyclically once a second as broadcast message. All other controllers receive these messages and set its internal clocks. Between two consecutive minute pulses the time master's internal clock runs independently ever providing the actual time.

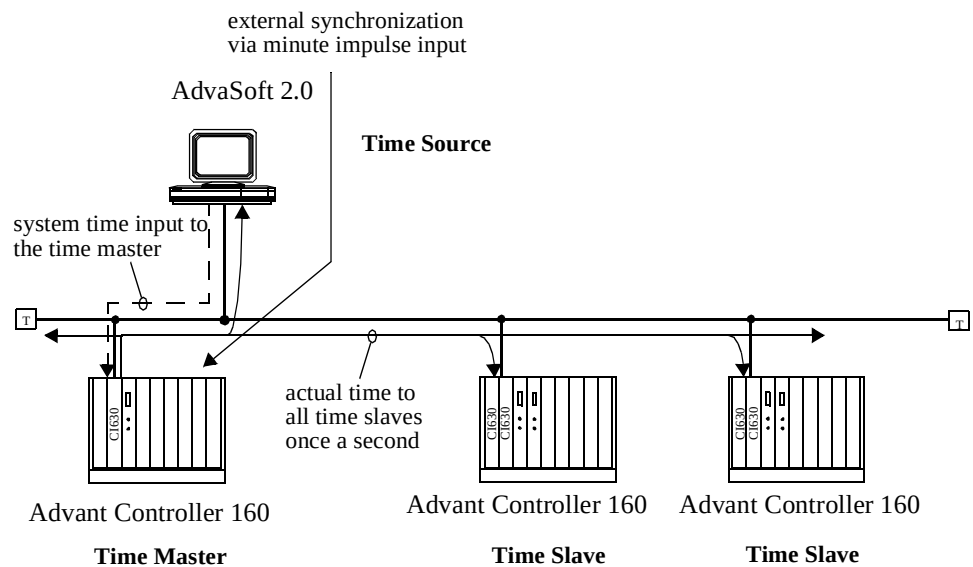


Figure 4-10. System Clock Synchronization, AC 160 and AdvaSoft

Control System with Superordinate Advant Controller 450

The configuration is shown in [Figure 4-11](#).

The controller Advant Controller 450 is time master. It can be synchronized via MB300 or via an external minute pulse. The other controllers at the Advant Fieldbus 100 are time slaves.

Advant Controller 450 cyclically sends time and date once per second as broadcast message via Advant Fieldbus 100.

The other controllers receive these messages and set its internal clocks.

Between two consecutive minute pulses the time master's internal clock runs independently ever providing the actual time.

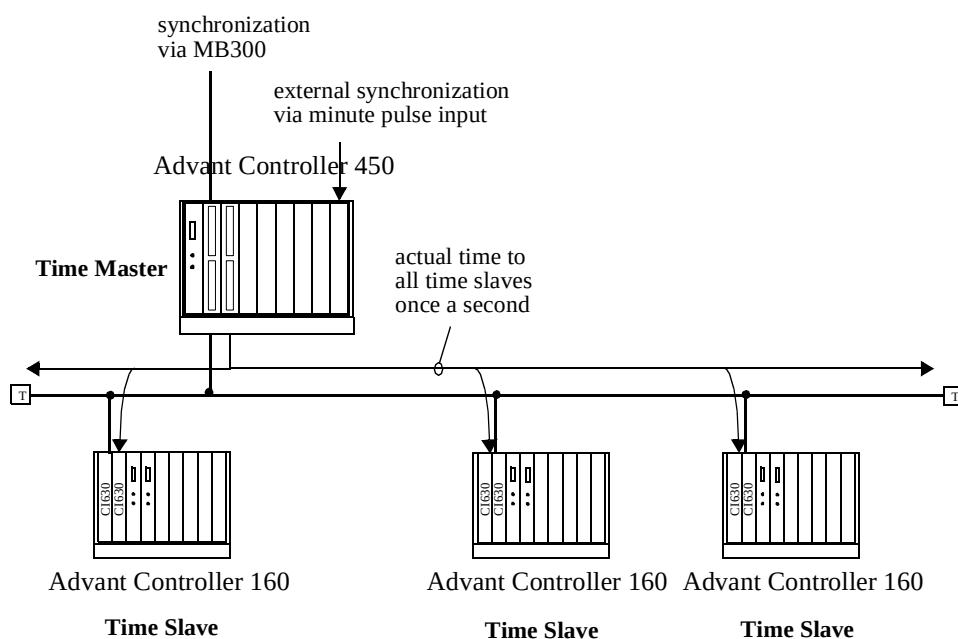


Figure 4-11. System Clock Synchronization with Advant Controller 450

Chapter 5 Mechanical Design

Mechanically, Advant Controller 160 consists of subracks, cable ducts, modules and process connectors.

The mechanical design of the S600 and S800 I/O modules are described in detail in two separate Product Guides.

The subracks and cable duct are designed for wall mounting.

The 10-position controller subrack, RF616, is the primary subrack. It provides dedicated positions for CPU, communication and bus extender modules. There is a two-digit thumb wheel switch for setting the station address. The individual module address is given by its position in the subrack.

The bus connector links the controller subrack to an optional extension subrack via a bus cable (TK612). The 10-position extension subrack, RF620, extends the number of I/O modules of a station. The individual module address is given by its position in the subrack.

The cable duct, RC610, holds the process cables. It also provides ten screw terminals for connecting the cable shields of process cables to ground.

Figure 5-1 shows the physical layout and Figure 5-2 the dimensions of a fully equipped subrack with cable duct.

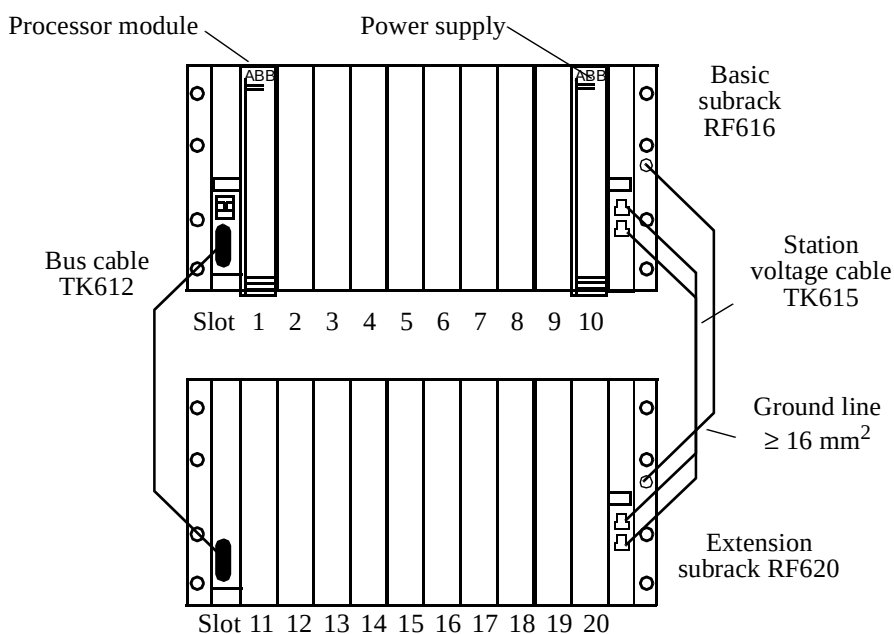


Figure 5-1. Physical Layout of Subrack

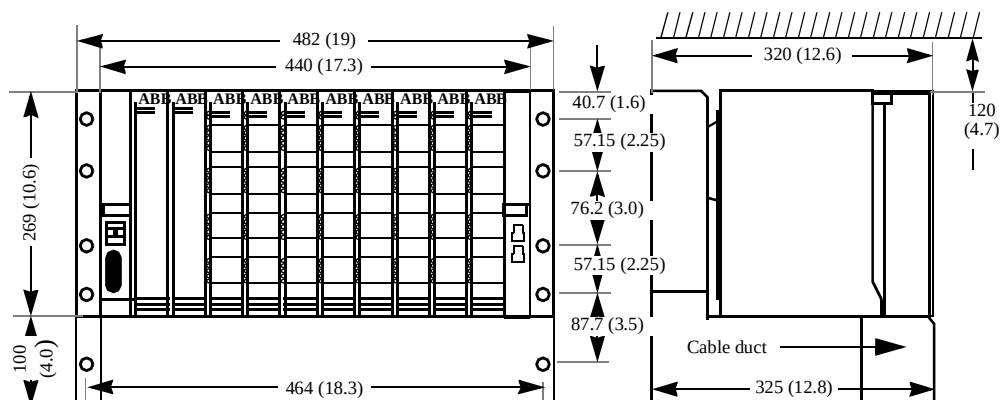


Figure 5-2. Dimensions of Subrack and Cable Duct

Advant Controller 160 can be delivered as separate subracks for mounting in any suitable cabinet, but it can also be delivered in standard RM5xx cabinets, please refer to [Chapter 8](#).

Full information for mounting Advant Controller 160 in cabinets is given in the cabinets chapter of the *Product Guide for Advant OCS with Master software, Overview*, or for details in the *Advant Controller 160 User's Guide*.

Chapter 6 Technical Data and Performance

6.1 General Data

The following configuration rules apply to an Advant Controller 160:

Table 6-1. The Maximum Configuration of Advant Controller 160

Item	Max. no.
I/O signals	1500 ⁽¹⁾
S600 I/O modules	75 ¹
Basic Units	1
Subrack per Basic Unit	2
S600 I/O stations	7
Subracks per I/O station	2
S800 I/O stations connected to Advant Fieldbus 100	32
S800 I/O modules per I/O station	24 ⁽²⁾
Advant Fieldbus 100 Communication Interface modules, main bus	1–2 ⁽²⁾ ⁽³⁾ ⁽⁴⁾
Advant Fieldbus 100 Communication Interface modules, subordinate bus	1–2 ⁽⁵⁾
Processor Modules (PM640, PM644, PM645 and PM646)	6 ⁽⁶⁾
Submodule carrier module (SC610)	1 ⁽⁷⁾ ⁽⁸⁾

- (1) These limits are not hard but practical ones.
- (2) 1 module CI626 or CI630 in position 2, 2 modules CI630 for redundant communication in position 1 and 2 of the controller basic subrack.
- (3) At least one CI626 or CI630 is required for any Advant Controller 160 configuration. For redundant processor modules 2 CI630 are recommended
- (4) For non redundant communication with AF 100 a CI626 module can be used instead of CI630
- (5) Usable communication interfaces for non redundant communication are CI626, CI627, CI630 or CI631, for redundant communication are CI630 or CI631
- (6) Must be put into the controller basic subrack (position3...8)
- (7) SC610 can hold up to two MVI modules
- (8) Not supported by dual redundant Processor Module (CPU redundancy), requires one PM640 or PM644 or PM645C or one PM645A/B in station redundancy

6.2 Communication

Data Set elements hold references to DAT elements. Up to eight DAT elements can be connected to one Data Set.

A DAT element can hold one variable representing:

- 32 Booleans (32 bits) or 1 real number (32 bits) or
- 1 long integer number (32 bits) or 1 short integer number (16 bits).

The Data Set communication service cyclically transfers information from the DAT elements specified in the sending controller to the DAT elements specified in the receiving controller. The cycle time for each Data Set can be selected from the range 2 ms to 4 s.

The Data Set communication service is based on the broadcast principle, allowing any station to receive any Data Set sent on the bus. The advantage of broadcasting is that information only needs to be transmitted once regardless of the number of receiving stations. This principle is highly efficient when the same information is required in two or more stations, especially in time-critical applications.

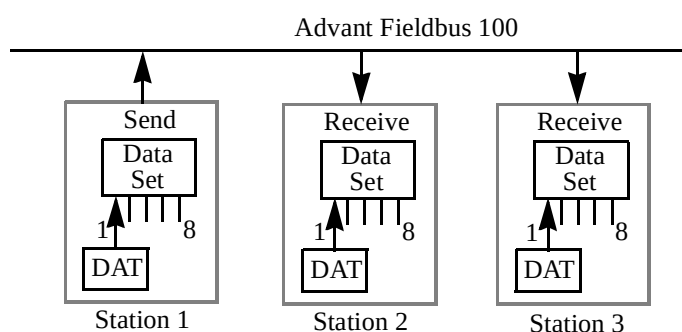


Figure 6-1. Data Set communication

The Data Set communication uses resources on Advant Fieldbus 100, in the Communication Interface modules and also in the Processor Module. The system data shown in [Table 6-2](#) and [Table 6-3](#) are valid both for the main control Advant Fieldbus 100 and the second (subordinate) control Advant Fieldbus 100.

Table 6-2. Data Set communication for Advant Controller 160

Description	Data per AF 100
Maximum number of Data Sets (send and receive) per Processor Module	200
Maximum number of Data Sets (send and receive) per controller	400
DAT elements per Data Set	1–8
Selectable cycle times	2.4–4096 ms

Advant Fieldbus 100 runs at 1.5 Mbits/s. The transfer time for one Data Set is shown in the following table.

Table 6-3. Data Set transfer times for Advant Fieldbus 100

Data Set size (DAT element per Data Set)	Transfer time T _{tr} (ms)
1	0.088
2	0.108
4	0.156
8	0.252

To estimate the bus load for a given application, the following formula should be used.

Bus load in % = $((N \times T_{tr}) / T_c) \times 100\%$, where:

N = the number of Data Sets (of the same size and T_c)

T_{tr} = the transfer time in ms (from the above table)

T_c = desired cycle time in ms (2, 4, 8, 16, ..., 4096)

The resulting load must not exceed 75 %, the remaining capacity must be reserved for background communication (e.g., remote programming).

Note that only the sending Data Sets are to be included in the calculation.

6.2.1 RCOM/RCOM+ Communication

An MVI channel may act as master or slave. In case of master operation it can have up to 25 slaves. Data between master and slave station is transferred using MVB elements (MVI data block) which is similar to Data Set elements. MVB elements hold references to DAT elements. 1 to 8 DAT elements can be connected to one MVB with RCOM. RCOM supports 1 to 8 DAT and RCOM+ supports 1 to 24 DATs.

Table 6-4. Data communication on RCOM/RCOM+

Description	Maximum No.
Number of nodes per MVI channel.	25 ⁽¹⁾
Number of RCOM/RCOM+ networks per Advant Controller 160 master.	4
Number of slaves per Advant Controller 160.	50 ¹
Number of MVB's per Advant Controller 160.	500
Number of MVB's per MVI channel.	340

(1) The maximum number of event generating slaves in an AC 110/AC 160 network is limited to 16.

The number of MVI data blocks that can be exchanged via the serial interface depends on the transmission speed and the specified cycle time. For performance estimation—including resulting CPU load—the figures for Advant Controller 110 within *Advant OCS Product Guide* as worst case figures can be used.

6.2.2 PROFIBUS-DP Communication

The PM644 is installed in the basic station of Advant Controller 160. It is equipped with one PROFIBUS-DP master interface which allows to use PROFIBUS I/O devices as distributed I/O. The setup of this link is defined by a number of database elements. The PROFIBUS link forms a local control network within the Advant system with the network numbers 1 to 9. Each I/O device may have a number from 0 to 125.

Table 6-5. Data communication on PROFIBUS-DP

Description	Maximum No.
Number of buses per PM644	1
Number of slaves per bus	125
Number of nodes ⁽¹⁾ per segment	32

(1) A node is a PROFIBUS slave, the repeater or master.

The maximum distances that can be covered with PROFIBUS-DP depend on the used transmission speed:

Table 6-6. Distance based on transmission speed on PROFIBUS-DP

Transmission Speed (Kbit/sec)	Distance / Segment (m)
9.6	1200
19.2	1200
93.75	1200
187.5	1000
500	400
1,500	200
12,000	100

6.3 Event Transfer and Detection

Events can be detected with Digital Input modules DI650, DI651, DI652, DI685, DI885 or as calculated DI events. After the detection of an event in Advant Controller 160 the event can re-transferred via RCOM/RCOM+ or Advant Fieldbus 100 to a Advant Controller 400 Series or to SattGraph 5000/AdvaSoft 2.0 for Windows NT Operator Station with OPC Server for further treatment. For each event queue (database element EVS(T) or EVS(S) in Advant Controller 160), up to 10 nodes on the Advant Fieldbus 100 network can be assigned to receive this event message.

The relative time errors between events detected in different Advant Controllers 160 within the same Advant Fieldbus 100 is < 10 ms. Relative time error within one controller is ≤ 1 ms. For more information about event transfer and detection, please refer to [Table 6-7](#).

Table 6-7. Event transfer and detection

Description	Maximum No.
Number of event queues per Processor Module.	32
Number of event entries per event queue.	1024
Number of event set elements per Processor Module.	32
Number of event detection elements per event set element.	32
Total number of event detection elements per Processor Module.	1024

Table 6-8. Event transfer and detection resolution

Description	Minimum
Accuracy of calculated events DIC, AIC.	10 ms (min.) ⁽¹⁾
Resolution of events from digital inputs (DI65x, DI685, DI885).	1 ms

(1) accuracy depends on selected scan time, with time stamp resolution 1 ms. Recommended scan time is 640 ms.

6.4 Interface for a Local Operator Station

Advant Controller 160 Processor Modules include an asynchronous serial interface (channel 2), which is intended only for communication with a PC-based Human Machine Interface (HMI) package (3rd party product). In Advant Controller 160 data is exchanged, with e.g. the HMI package, by means of PAR DAT elements. The supported communication protocol on this serial interface is the MODBUS I protocol. The serial interface on the CPU can only be used as a slave on MODBUS.

The number of MODBUS I commands that can be exchanged via the serial interface is depending on the type of command and also on the load of the CPU. For performance estimation the figures for Advant Controller 110 within Advant OCS Product Guide as worst case figures can be used.

6.5 Cycle and Scan Times

An Advant Controller 160 application program consists of one AMPL program (PCPGM) which can be further divided into a maximum of 31 execution modules (CONTRM, MASTER) or sequence modules (SEQ). Note that SEQ and STEP cannot be used with redundant processing. Instead GRC and P_STEP can be used. Different cycle-times may be assigned to the execution modules so that the AMPL program can include both fast and slow control functions. Cycle times can be chosen from the range 2 ms – 20 s in steps of 2 ms. For applications with redundant Processor Modules cycle times smaller than 10 ms are not applicable.

For triple redundant configuration maximum cycle time is 1 s.

Control tasks with shorter cycle times always have a higher priority than those with longer cycle times. The execution order of modules with equal cycle times can be selected explicitly. Activation once at start can be chosen by the CONTRM's call parameter C2.

6.6 I/O Scanning

The scanning of I/O modules is directly related to the cycle time of the execution module.

Each execution module reads its inputs before execution of its AMPL elements. This guarantees a consistent image of the process signals. After execution of the AMPL elements, the module writes the calculated results to the outputs.

6.7 CPU Load Calculation

To determine the CPU load for an Advant Controller 160, the maximum load values available for the application program as shown in [Table 6-9](#) must be considered.

Table 6-9. Maximum usable CPU load for application program

CPU configuration	Maximum load per CPU [%]	Maximum load per controller with single CPUs [%]	Maximum load per controller with redundant CPU pairs [%]
2 single CPUs or 1 redundant pair	70	2×70	70
4 single CPUs or 2 redundant pairs	70	4×60	2×60
6 single CPUs or 3 redundant pairs	70	6×50	3×50

6.8 CPU Load Calculation, Data Set Communication

The OCS Product Guides provides load data from Data Set communication for Advant Controller 110. These data can be used for Advant Controller 160 if divided by 3.

6.9 Memory Requirements

1 Mbyte of memory is available for the application program. For a rough calculation of the application memory requirements, the following table can be used.

Table 6-10. Memory requirements for 7 different application programs

Program No.	Program description	Input/Output Data Set	Needed memory size (kByte)
1	1 CONTRM with 16×3 input AND.	48 inputs 16 outputs	3.25
2	1 CONTRM with 32×2 input AND.	64 inputs 32 outputs	3.75
3	1 CONTRM with 32×2 input AND + 1 CONTRM with 16×2 input AND.	96 inputs 48 outputs	6.0

Table 6-10. Memory requirements for 7 different application programs (Continued)

Program No.	Program description	Input/Output Data Set	Needed memory size (kByte)
4	5 CONTRM each with 32×2 input AND.	320 inputs 160 outputs	12.0
5	2 CONTRM each with 16×2 input AND + 15 CONTRM each with 32×2 input AND.	1024 inputs 512 outputs	37.5
6	As 3 plus 1 CONTRM with each 5×4 inputs and outputs via Advant Fieldbus 100.	96 inputs 48 outputs 10 Data Sets (each DS with 4 DATs)	8.6
7	As 3 plus 1 CONTRM with each 50×4 inputs and outputs via Advant Fieldbus 100.	96 inputs 48 outputs 100 Data Sets (each DS with 4 DATs)	19.1

Chapter 7 Environmental Immunities

7.1 Environmental Considerations

General

Advant Controller 160 is designed for a demanding industrial environment. Alternative cabinets is available for different degrees of protective rating (IP21, IP41, IP54). Interference from electrical sources is suppressed by a suitable solid design and particular installation rules. The building where the system is to be stored or installed should provide an environment such that established environmental conditions are not normally exceeded.

A hardened enclosure protects the printed circuit boards from mechanical and electrostatic damage and from electromagnetic interference. The equipment complies with the EC directives 89/336/EEC on electromagnetic compatibility and 73/23/EEC on low-voltage apparatus. Limit values are given to: Corrosive gases, Temperature, Vibration, Moisture, Electro-Magnetic Compatibility, etc.

For further information about the environmental immunity, please refer to the Environmental Immunities chapter in the *Advant OCS with Master software, Overview* Product Guide.

Temperature

It is important to note the temperature within cabinets and in the surrounding environment and atmosphere. Lower temperatures mean increased system reliability and availability.

The lives of wet, electrolytic capacitors and most semiconductors are greatly reduced if the maximum permitted temperatures are exceeded.

To avoid overheating, when ambient temperatures are high, take into consideration the heat dissipated in the cabinet. This is particularly important with sealed cabinets (IP54) with considerable number of circuit boards and ambient temperatures at levels approaching 40°C. It might be necessary to mount heat exchangers on the cabinet to bring down the temperature to levels below limits given in the environmental data sheet.

The different hardware modules in the controller and the I/O system have different outputs of heat. Accurate calculation of the heat produced by the system requires knowledge of the modules and the work cycle.

Maximum permitted temperature above the subracks in the cabinet is 55°C.

NOTE

There is normally no requirements for fans in an Advant Controller 160.

Chapter 8 Ordering

8.1 Price List Structure

Depending on the desired I/O configuration one or several price lists must be used when ordering an Advant Controller 160 with local S600 I/O, distributed S800 I/O or additional hardware modules to support enhanced features, e.g., burner management, turbine control, or safety applications.

Advant Controller 160 Version 1.2 (3BSE014373)

See this Product Guide and also the S800 I/O Product Guide.

S800 I/O can only be ordered as separate parts. Use only one copy of the price list.

Additional Hardware Modules (3BDS100580)

Price list of Regional Center (RC)-Germany.

See this Product Guide. Corresponding Article No's marked with RC-Germany.

Discontinued Articles

The following articles are no longer available and cannot be ordered, for details see [Table 8-28](#):

Analog selector switch 4-fold, each for 3 inputs and 1 output
Binary selector switch 8-fold, each for 3 inputs and 1 output
I/O interface cable set
Redundancy test module
Relay unit with 6 relays, 3 of them configured as 2oo3

8.2 Assembled Delivery or Loose Part Delivery

The item **Assembly and test** in [Table 8-1](#) determines if the controller shall be mounted in cabinets or not. If this item is not ordered the delivery will be a loose part delivery.

Note also that in [Table 8-1](#) the items for CE-marking are different for an assembled delivery and for a loose part delivery.

8.3 Loose Part Delivery and CE-marking

If an Advant Controller 160 is ordered as a loose part delivery and the intention is to mount the equipment in other cabinets than RM500, certain considerations must be taken to make it follow the provisions of the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC.

- The cabinet or series of cabinets mounted side by side must be radio-proof.
- Protection against line conducted radio emissions is obtained by means of a mains net filter placed in the cabinet close to the incoming mains cable.
- Communication cable shields must have a capacitive grounding at the point where they enter the cabinet.

The conditional EC - Declaration of Conformity, which accompanies the loose part delivery, must be signed by the person responsible for assembling the controller in cabinets.

8.4 Reference Guide

Reference Guide for Price List **3BSE014373-A**.

8.4.1 General Requirements

Table 8-1. General and Normative Requirements

Description	Consists of	Article No.
CE-marking , Cabinet Mounted Delivery	EC Declaration of Conformity Mains Filter.	3BSE009129R1
CE-marking , Loose Parts Delivery	Conditional EC Declaration of Conformity.	3BSE009130R1
Assembly and test of subracks	—	3BSE016033R1

8.4.2 Basic Unit

Table 8-2. Basic Units

Description	Consists of	Article No.
Basic Unit Advant Controller 160 with PM640 consisting of: - PM640, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM640 RF616 RC610 BASE sw incl. OPT2 and OPT3 on 3.5" diskette.	3BSE010990R2
Basic Unit Advant Controller 160 with PM645A consisting of: - PM645A, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM645A RF616 RC610 BASE sw incl. OPT2 and OPT3 on 3.5" diskette.	3BSE010991R2
Basic Unit Advant Controller 160 with PM645B consisting of: - PM645B, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM645B RF616 RC610 BASE sw incl. OPT2 and OPT3 on 3.5" diskette.	3BSE010992R2
Basic Unit Advant Controller 160 with PM645C consisting of: - PM640, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM645C RF616 RC610 BASE sw incl. OPT2 and OPT3 on 3.5" diskette.	3BSE010993R2
Basic Unit Advant Controller 160 with PM644 consisting of: - PM644, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM644 RF616 RC610 BASE sw, incl. OPT2 and OPT3 on 3.5" diskette.	3BDS005641R1
Basic Unit Advant Controller 160 with PM646 consisting of: - PM646, Subrack, Cable duct, basic software with support for CI532, SC610, and event handling	PM646 RF616 RC610 BASE sw OPT2, OPT3 on 3.5" diskette.	3BDS005642R1

8.4.3 Software Options

Software options are to be ordered only for a Basic Unit.

Table 8-3. Software Options

Description	Consists of	Article No.
OPT1 , Software Option 1, extended AMPL PC element set.	Software on 3.5" disk.	3BDS005567R1
OPT4 , Software Option 4, MODBUS I protocol for HMI communication via PM640 or PM644 or PM645 or PM646.	Software on 3.5" disk.	3BDS005570R1
OPT6 , Software Option 6, PC elements for station redundancy and rotational speed measurement.	Software on 3.5" disk.	3BDS005571R1

8.4.4 Hardware Options

Table 8-4. Hardware Options

Description	Consists of	Article No.
Dummy module	RB601	3BSE002803R1
I/O Fan unit 24 V	RC620	3BSE003097R1
CPU Communication Cable Set	W173	GKWF310703R1
Processor Module , non redundant processing	PM640	3BSE010534R1
Processor Module , non redundant processing, PROFIBUS-DP, rotational speed signal input	PM644	3BSE014664R1
Processor Module , for redundant processing, high speed link	PM645A	3BSE010536R1
Processor Module , for redundant processing, high speed link, rotational speed signal input	PM645B	3BSE010535R1
Processor Module , for parallel processing, high speed link, rotational speed signal input	PM645C	3BSE010537R1
Processor Module , for redundant processing with additional monitoring functions for safety application systems	PM646	3BSE014700R1

8.4.5 Communication

Table 8-5. Advant Fieldbus 100

Description	Consists of	Article No.
Advant Fieldbus 100 terminator kit coaxial (1 kit required per bus cable)	1 × 75 Ω BNC terminator plug 1 × ditto with ground lead	3BSE006244R1
Modem for Advant Fieldbus 100 conversion coaxial/optical	TC630	3BSE002253R1
Ci626 Advant Fieldbus 100 interface kit to single line (coaxial)	1 Bus interface Ci626, AF 100 connector kit for one bus line only	3BSE004006R1
Ci627 Communication Interface (twisted pair)	1 Bus interface Ci627, 2 connectors for AF 100	3BSE009799R1
Ci630 Advant Fieldbus 100 interface kit to single line (coaxial)	1 Bus interface Ci630, AF 100 connector kit for one bus line only	3BSE011001R1
Ci630 Advant Fieldbus 100 interface kit to redundant bus (coaxial)	1 Bus interface Ci630, AF 100 connector kit for redundant AF 100 (both bus lines)	3BSE011002R1
Ci631 Communication Interface (twisted pair)	1 Bus interface Ci631, 2 connectors for AF 100	3BSE016347R1
Modem for Advant Fieldbus 100 conversion coaxial/twisted pair	TC513V1	3BSE018405R1
Advant Fieldbus 100 terminator twisted pair (1 required per bus cable)	TC501V150	3BSC550038R1
Advant Fieldbus 100 Trunk Tap for twisted pair	TC506	3BSC840074R1
Modem for Advant Fieldbus 100 conversion twisted pair/optical	TC514V1	3BSE013240R1
Modem for Advant Fieldbus 100 repeater twisted pair/twisted pair	TC515V1	3BSE013243R1
Advant Fieldbus 100 Connection Kit to optical	AF100K01	3BSE005544R1

Table 8-5. Advant Fieldbus 100 (Continued)

Description	Consists of	Article No.
Advant Fieldbus 100 Connection Kit to redundant bus coaxial (two bus lines)	AF100K02	3BSE005545R1
Advant Fieldbus 100 Connection Kit for single line	AF100K03	3BSE006251R1

Table 8-6. Multi Vendor Interface

Description	Consists of	Article No.
MVI , Multi Vendor Interface with RCOM/RCOM+ protocol. It holds two buses.	CI532V01	3BSE003826R1
MVI , Multi Vendor Interface with MODBUS protocol. It holds two buses.	CI532V02	3BSE003827R1
MVI , Multi Vendor Interface with Siemens 3964(R) protocol. It holds two buses.	CI532V03	3BSE003828R1
Submodule carrier , required for connection of CI532. Two CI532 fit into one carrier.	SC610	3BSE001552R1

8.4.6 Packaging Options

Table 8-7. RM5xx Cabinets (width 800 mm)

Description	Consists of	Article No.
Cabinet RM521 ventilated cabinet IP21, height = 2125 mm	RM521	3BSE016063R1
Cabinet RM524 ventilated cabinet IP21, height = 1925 mm	RM524	3BSE016066R1
Cabinet RM522 ventilated cabinet IP41, height = 2125 mm	RM522	3BSE016064R1
Cabinet RM525 ventilated cabinet IP41, height = 1925 mm	RM525	3BSE016067R1
Cabinet RM523 sealed cabinet IP54, height = 2125 mm	RM523	3BSE016065R1
Cabinet RM526 sealed cabinet IP54, height = 1925 mm	RM526	3BSE016068R1

Table 8-7. RM5xx Cabinets (width 800 mm) (Continued)

Description	Consists of	Article No.
End panel for RM5xx cabinets (2125 mm)	End panel	3BSE016253R1
End panel for RM5xx cabinets (1925 mm)	End panel	3BSE016252R1
Shield plate , to be used between cabinets in a row (2125 mm)	Shield plate	3BSE016255R1
Shield plate , to be used between cabinets in a row (1925 mm)	Shield plate	3BSE016258R1

Table 8-8. RM5xx Cabinets (width 700 mm)

Description	Consists of	Article No.
Cabinet RM507 ventilated cabinet IP21, height = 2225 mm	RM507	3BSE016051R1
Cabinet RM537 (no CE-marking) IP21, height = 2225 mm	RM537	3BSE016155R1
End panel for RM5xx cabinets (2225 mm)	End panel	3BSE016254R1
Shield plate , to be used between cabinets in a row (2225 mm)	Shield plate	3BSE016257R1

Table 8-9. Power Supply in Rack

Description	Consists of	Article No.
Power supply module Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c. Fits subrack	SA610 Open-ended mains cable Connector for relay output	3BSE000655R1

Table 8-10. Power Supply in RM5xx (width 800 mm)

Description	Consists of	Article No.
Power supply Kit Input: 120 V a.c. Output: 24 V, 10 A, d.c.	SA161 Including power switch, mounting plate and cables	3BSE005746R1
Power supply Kit Input: 230 V a.c. Output: 24 V, 10 A, d.c.	SA162 Including power switch and cables	3BSE005747R1
Power supply Kit Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c.	SA610 Including power switch, mounting plate and cables	3BSE005748R1

Table 8-11. Power Supply in RM5xx (width 700 mm)

Description	Consists of	Article No.
Power supply Kit Input: 120 V a.c. Output: 24 V, 10 A, d.c.	SA161 Including power switch, mounting plate and cables	3BSE007040R1
Power supply Kit Input: 230 V a.c. Output: 24 V, 10 A, d.c.	SA162 Including power switch and cables	3BSE007041R1
Power supply Kit Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c.	SA610 Including power switch, mounting plate and cables	3BSE007042R1

Table 8-12. Cable Set for Redundant and Parallel Processing

Description	Consists of	Article No.
CPU connection cable set for data exchange (parallel processing), l = 30 cm	TK661V003	3BSE010995R1
CPU connection cable set for data exchange (parallel processing), l = 50 cm	TK661V005	3BSE010995R2
CPU connection cable set for data exchange (parallel processing), l = 6 m	TK661V060	3BSE010995R3

Table 8-12. Cable Set for Redundant and Parallel Processing (Continued)

Description	Consists of	Article No.
CPU connection cable set for data exchange (parallel processing), l = 8 m	TK661V080	3BSE010995R4
CPU connection cable set for redundancy, l = 30 cm	TK662V003	3BSE010996R1
CPU connection cable set for redundancy, l = 6 m	TK662V060	3BSE010996R2
CPU connection cable set for redundancy, l = 8 m	TK662V080	3BSE010996R3

8.4.7 S600 I/O

Table 8-13. I/O units

Description	Consists of	Article No.
I/O station , non redundant bus extender	Subrack RF615, Cable duct RC610 Bus extender CI610	3BSE000650R1
I/O station , redundant bus extender	Subrack RF615, Cable duct RC610 2 Bus extenders CI610	3BSE011004R1
I/O extension kit	Subrack RF620, Cable duct RC610 Bus cable TK612, Power cable TK615	3BSE011071R1
I/O bus extension kit	Bus extender CI615 for base station Bus terminator TC610 for I/O extension bus	3BSE000756R1

Table 8-14. Analog Input Modules

Description	Consists of	Article No.
32 channels, 12 bits resolution , single ended, 0-20 mA, shunt 250 Ω	AI610	3BHT300000R1
16 channels, 12 bits resolution , differential, 0-20 mA, 4-20 mA, ± 20 mA or ± 10 V, shunt 250 Ω , CMV 100 V, CMRR > 80 dB (16 2/3, 50 or 60 Hz)	AI620	3BHT300005R1

Table 8-14. Analog Input Modules (Continued)

Description	Consists of	Article No.
16 channels, 12 bits resolution , galvanic isolated as one group, 0-20 mA, CMV 50 V, CMRR> 100 dB, Shunt 100 Ω	AI625	3BHT300036R1
12 channels for Pt100 or resistance , 3- or 4-wire (2 wire with extra wiring on process connector), 13 bits resolution, -200 to +600°C or 0-500 Ω , 0.5 V, CMRR > 100 dB, opto-isolated as one group	AI630	3BHT300011R1
14 channels for thermocouple or millivolts and 2 channels for ambient (CJ) temperature measurement with Pt100 , 12 bits resolution, CMRR > 120 dB, opto-isolated as one group	AI635	3BHT300032R1

Table 8-15. Analog Output Modules

Description	Consists of	Article No.
16 channels, 12 bits resolution , 0-20 mA, 0-10 V, opto-isolated as one group	AO610	3BHT300008R1
8 channels, 12 bits resolution , 0-20 mA, 4-20 mA $\pm$ 20 mA, 0-5 V, 0-10 V, 1-5 V, $\pm$ 10 V, each channel opto-isolated	AO650	3BHT300051R1

Table 8-16. Analog Input/Output Modules

Description	Consists of	Article No.
AX645, 16 analog input channels , 4-20 mA, each configurable as input or output, 14 Bits resolution for input, 16 Bits resolution for output, opto-isolated as one group	AX645	(RC-Germany)
AX646, 16 analog input channels 4-20 mA, isolated from the system as one group, short-circuit and open-circuit proof. The 16 analog output channels will be switched over periodically to the related inputs for input tests. The output channels are not available for the user. Input range 4...20 mA.	AX646	(RC-Germany)

Table 8-17. Digital Input Modules

Description	Consists of	Article No.
32 channels, 24 V d.c. , non-isolated	DI610	3BHT300004R1
32 channels, 24 V d.c. , opto-isolated in four groups	DI620	3BHT300002R1
32 channels, 48 V d.c. , opto-isolated in four groups	DI621	3BHT300012R1
32 channels, 60 V d.c. , opto-isolated in four groups	DI622	3BHT300013R1
16 channels, 120 V a.c. , opto-isolated in four groups	DI635	3BHT300015R1
16 channels, 230 V a.c. , opto-isolated in four groups	DI636	3BHT300014R1
32 channels, 24 V d.c. , opto-isolated in four groups, sequence of event or pulse catching capability	DI650	3BHT300025R1
32 channels, 48 V d.c. , opto-isolated in four groups, sequence of event or pulse catching capability	DI651	3BHT300026R1

Table 8-17. Digital Input Modules (Continued)

Description	Consists of	Article No.
32 channels, 60 V d.c. , opto-isolated in four groups, sequence of event or pulse catching capability	DI652	3BHT300027R1
32 channels, 24/48 V d.c. , internal 48 V sensor power supply, opto-isolated, sequence of event capability, wire break supervision	DI685	3BSE011613R1

Table 8-18. Digital Output Modules

Description	Consists of	Article No.
32 channels, 24 V d.c. , short-circuit proof transistors, max. 200 mA, non-isolated	DO610	3BHT300006R1
32 channels, < 60 V d.c. , short-circuit proof transistors, max. 0.5 A, opto-isolated in four groups	DO620	3BHT300009R1
16 channels, 24 V d.c. , short-circuit proof transistors, max. 2.4 A, isolated in eight groups	DO625	3BHT300040R1
16 channels, 24-250 V a.c./d.c. , relay contacts ^{(1), (2)}	DO630	3BHT300007R1
6 channels, < 60 V d.c. , relay contacts each output separately isolated.	DX610	3BSE013087R1

(1) Relay data Load current: max 2 A min 20 mA Breaking Capacity: a.c. max 500 VA d.c. max 40 W

(2) Relay data Load current: max 2 A, Breaking Capacity: max 120 W for d.c. loads

Table 8-19. Pulse Counting Module

Description	Consists of	Article No.
5 counter channels , each with two counter inputs, max 100 kHz and one Strobe and one Set input, ± 13 mA, 24 V d.c. or 5 V d.c. (only 24 V for Set), each input individually opto-isolated, connection via 15 Pin Sub-D for each channel. Operation modes: 1. Up- & down- counting 2. Frequency & difference measurement 3. Difference measurement 4. Position & rotational speed measurement	DP620	3BHT300016R1
Speed meter input max 50 kHz, ± 13 mA, 24 V d.c. or 5 V d.c., detection of direction through second speed meter input, over-speed trip logic with trip signal output via solid state 24 V d.c. and dry contact 60 V d.c., speed meter inputs and solid state output are individually opto-isolated.	DP640	(RC-Germany)

Table 8-20. Power Supply for Field equipment

Description	Consists of	Article No.
Single a.c Power Supply Input: 120 V a.c., 50/60 Hz Output: 24 V, 10 A, d.c., unregulated	SA161 SX554 TK402V027	3BSE003591R1
Single a.c Power Supply Input: 230 V a.c., 50/60 Hz Output: 24 V, 10 A, d.c., unregulated	SA162 SX554 TK402V027	3BSE003592R1
Single a.c Power Supply Input: 120 V a.c., 50/60 Hz Output: 48 V, 5 A, d.c., unregulated	SA171 SX554 TK402V027	3BSE003593R1
Single a.c Power Supply Input: 230 V a.c., 50/60 Hz Output: 48 V, 5 A, d.c., unregulated	SA172 SX554 TK402V027	3BSE003594R1

8.4.8 Cables and Connectors

Table 8-21. Cables and Connectors

Description	Consists of	Article No.
Front connector with screw terminals	TF620	3BHT100013R1
Process cable w. fitted connector TF610, unscreened, l = 3 m (9.8 ft.)	TK630V030	3BSC950007R1
Process cable w. fitted connector TF610, unscreened, l = 5 m (16 ft.)	TK630V050	3BSC950007R2
Process cable w. fitted connector TF610, unscreened, l = 10 m (32.8 ft.)	TK630V110	3BSC950007R3
Process cable w. fitted connector TF610, screened, l = 3 m (9.8 ft.)	TK640V030	3BSC950008R1
Process cable w. fitted connector TF610, screened, l = 5 m (16 ft.)	TK640V050	3BSC950008R2
Process cable w. fitted connector TF610, screened, l = 10 m (32.8 ft.)	TK640V110	3BSC950008R3
Terminal unit TX650 one per I/O module is required	AC110K11	3BSC840005R1
Mounting bar for terminal unit RA620	AC110K09	2166 0559-F
Cable from base to I/O station, 2.5 m (8 ft.)	TK610V025	3BHT200007R1
Cable from base to I/O station, 5 m (16 ft.)	TK610V050	3BHT200008R1
Cable from base to I/O station, 10 m (32 ft.)	TK610V110	3BHT200009R1

8.4.9 S800 I/O

Table 8-22. Field Communication Interface

Description	Consists of	Article No.
AF100 Communication Interface for Modulebus connected to a single or cable redundant Advant Fieldbus 100 (twisted pair cable).	CI810V2	3BSE008584R1
Redundant AF100 Communication Interface for Modulebus connected to an Advant Fieldbus 100 (twisted pair cable). ⁽¹⁾	CI820	3BSE013200R1

(1) Two CI820 must be ordered for redundancy.

Table 8-23. I/O modules for S800 I/O

Description	Consists of	Article No.
Analog Input, 8 channels , 12 bit resolution, single ended, 0 to 10 V or 0 (4) to 20 mA, shunt 250 Ω , rated isolation 50 V	AI810	3BSE008516R1
Analog Input 4 channels , 12 bit + sign, differential, 20...20 mA, -5...5 V, -10...10 V, CMV 50 V, shunt 250 Ω , rated isolation 50 V	AI820	3BSE008544R1
Analog input, 8 channels , for RTD Pt-100, Ni-100, Ni-120, Cu10, R, 14 bit resolution, rated isolation 50 V	AI830	3BSE008518R1
Analog Input, 8 channels , for thermocouples, 14 bit resolution, characteristics B, C, E, J, K, N, R, S, T, -30...75 mV, rated isolation 50 V	AI835	3BSE008520R1
Analog Output, 8 channels , 14 bit resolution, 0 (4) to 20 mA, R_{load} max 500/1000 Ω , rated isolation 50 V	AO810	3BSE008522R1
Analog Output 4 channels , 12 bit + sign, individually isolated, -20...20 mA, -10...10 V, current output RL maximum 550 Ω , voltage output RL minimum 2 k Ω , rated isolation 50 V	AO820	3BSE008546R1
Digital Input, 2×8 channels, 24 V d.c. , rated isolation 50 V	DI810	3BSE008508R1
Digital Input, 2×8 channels, 48 V d.c. , rated isolation 50 V	DI811	3BSE008552R1
Digital Input, 2×8 channels , 24 V d.c., current source, rated isolation 50 V.	DI814	3BUR001454R1
Digital Input, 8×1 channels , 120 V a.c., individually electrical isolated channels, rated isolation 250 V	DI820	3BSE008512R1
Digital Input, 8×1 channels , 230 V a.c., individually electrical isolated channels, rated isolation 500 V	DI821	3BSE008550R1
Digital Input, 1×8 channels , 24/48 V d.c., SOE, rated isolation 50 V	DI885	3BSE013088R1
Digital Output, 2×8 channels , 24 V d.c., max 0.5 A, rated isolation 50 V, short-circuit proof transistor outputs, current sourcing	DO810	3BSE008510R1

Table 8-23. I/O modules for S800 I/O (Continued)

Description	Consists of	Article No.
Digital Output, 2×8 channels , 24 V d.c., max 0.5 A, rated isolation 50 V, short-circuit proof transistor outputs, current sink.	DO814	3BUR001455R1
Digital Output, 2×4 channels , 24 V d.c., max 2 A, rated isolation 50 V, short-circuit proof transistor outputs, current sink.	DO815	3BSE013258R1
Digital Output, 8×1 channels , 24-230 V a.c., rated isolation 250 V, individually electrical isolated channels relay outputs (n.o.) ⁽¹⁾	DO820	3BSE008514R1
Digital Output, 8×1 channels, 24–230 V a.c. , rated isolation 250V, individually electrical isolated channels relay outputs (n.o.) ⁽²⁾	DO821	3BSE013250R1

(1) Relay data: Load current: min 5 mA, max 3 A, at 250 V a.c. or 40 W d.c.
Breaking capacity: 1000 VA or 240 W at $\cos \phi > 0.4$

(2) Relay data: Load current: min 5mA, max 3A, at 250 V a.c. or 40W d.c.
Breaking capacity: 1000VA or 240 W at $\cos j > 0.4$

Table 8-24. Details for Modulebus Termination Units

Description	Consists of	Article No.
Module termination unit (MTU) , compact, 2×8 signal terminals, rated isolation 50 V	TU810V1	3BSE013230R1
Module termination unit (MTU) , compact, 1×8 signal terminals, rated isolation 250 V	TU811V1	3BSE013231R1
Module termination unit (MTU) , compact, 25 pin D-sub connector, rated isolation 250 V	TU812V1	3BSE013232R1
Module termination unit (MTU) , compact, 2×16 signal terminals, rated isolation 250 V	TU814V1	3BSE013233R1
Module termination unit (MTU) , extended, 2×16 signal terminals, rated isolation 50 V	TU830V1	3BSE013234R1
Module termination unit (MTU) , extended, 2×8 signal terminals, rated isolation 250 V	TU831V1	3BSE013235R1
Module termination unit (MTU) , extended, individually fused, rated isolation 50 V	TU835	3BSE008564R1
Module termination unit (MTU) , extended, two groups, individually fused, rated isolation 250 V	TU836V1	3BSE013237R1
Module termination unit (MTU) , extended, individually fused, rated isolation 250 V	TU837V1	3BSE013238R1

Table 8-24. Details for Modulebus Termination Units (Continued)

Description	Consists of	Article No.
Module termination unit (MTU) , extended, individually fused, rated isolation 250 V	TU838	3BSE008572R1
Extra Label set for MTU (item designation)	–	3BSC970090R1
Module Interconnection unit	TB815	3BSE013204R1

Table 8-25. Communication Parts for Modulebus

Description	Consists of	Article No.
Cable adaptor, output , D-sub 25, female	TB805	3BSE008534R1
Cable adaptor, input , D-sub 25, male	TB806	3BSE008536R1
Extension cable ⁽¹⁾ for Modulebus, 0.3 m (1 ft.)	TK801V003	3BSC950089R1
Extension cable ⁽¹⁾ for Modulebus, 0.6 m (2 ft.)	TK801V006	3BSC950089R2
Extension cable ⁽¹⁾ for Modulebus, 1.2 m (4 ft.)	TK801V012	3BSC950089R3
Modulebus Terminator	TB807	3BSE008538R1
Modulebus Optical port 10 Mbit/s for communication with S800 I/O cluster	TB810	3BSE008560R1
Modulebus Optical port 5 Mbit/s for drive equipments	TB811	3BSE008568R1
Optical Modulebus modem	TB820V1	3BSE013246R1
Optical Modulebus expansion cable , Optical duplex cable plastic fibre, 1.5 m (5 ft.)	TK811V015	3BSC950107R1
Optical Modulebus expansion cable , Optical duplex cable plastic fibre, 5 m (16.7 ft.)	TK811V050	3BSC950107R2
Optical Modulebus expansion cable , duplex cable plastic fibre, 15 m (49 ft.)	TK811V150	3BSC950107R3
Optical Modulebus expansion cable , optical simplex cable plastic fibre, 1.5 m (5 ft.)	TK812V015	3BSC950118R1
Optical Modulebus expansion cable , optical simplex cable plastic fibre, 5 m (16.7 ft.)	TK812V050	3BSC950118R2
Optical Modulebus expansion cable , optical simplex cable plastic fibre, 15 m (49 ft.)	TK812V150	3BSC950118R3

(1) One set of TB805 and TB806 per each extension cable is required

Table 8-26. Power Supply for S800 I/O

Description	Consists of	Article No
Power supply , rated isolation 250 V Input: 100-240 V a.c. Output: 24 V d.c., 2.5 A	SD811	3BSC610022R1
Power supply , rated isolation 250 V Input: 100-240 V a.c. Output: 24 V d.c., 5 A	SD812	3BSC610023R1

8.4.10 Documentation

Table 8-27. Documentation on Advant Controller 160

Title	Description	Article No.
Advant OCS with Master SW User Documentation on CD-ROM	Complete Documentation of Advant OCS with Master software on CD-ROM.	3BSE008143R1001
WWW Access to Advant OCS Documentation	Subscription for one year, single user.	3BSE001228R0001
WWW Access to Advant OCS Documentation	Subscription for 5 years, single user.	3BSE001503R0001
Advant Controller 160 User's Guide	User's Guide describing the AC 160 equipment and how to install and commission the system	3BDS005555R1
Data Base Elements Advant Controller 160 Reference Manual	Reference Manual describing the DB Elements used in Advant Controller 160	3BDS005556R1
PC Elements Advant Controller 160 Reference Manual	Reference Manual describing the PC Elements used with Advant Controller 160	3BDS005557R1
AMPL Configuration Advant Controller 100 Series Reference Manual	Contains instructions about configuration and application programming, fault tracing, execution, memory and load calculation of Advant Controller 110 and 160	3BSE009626R401

Table 8-27. Documentation on Advant Controller 160 (Continued)

Title	Description	Article No.
S600 I/O Hardware Reference Manual/ Rev B	Reference Manual describing the I/O and interface modules used with Advant Controller 100 Series	3BSE011123R0001
S600 I/O Hardware Advant Controller 160 Reference Manual	Reference Manual describing the I/O and interface modules used with Advant Controller 160	3BDS005558R1
Advant Fieldbus 100 User's Guide	User's Guide for Advant Fieldbus 100, containing a technical description, technical data and instructions for installation, commissioning and fault tracing used	3BSE000506R701
RCOM Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing of <u>R</u> emote <u>C</u> OMMunication in Advant Controller 110 and 160	3BSE003181R1
MultiVendor Interface - MODBUS Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing for MVI/MODBUS in Advant Controller 110 and 160	3BSE006712R1
MultiVendor Interface - Siemens 3964(R) Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing for MVI/Siemens 3964(R) in Advant Controller 110 and 160	3BSE006713R1
S800 I/O User's Guide	User's Guide describing the I/O and interface modules used with S800 I/O	3BSE008878R301
Advant Controller 160 PROFIBUS-DP User's Guide	User's Guide for PROFIBUS-DP, containing a technical description, technical data and instructions for installation, commissioning and fault tracing used	3BDS005500R1
89AU31R0100 Changeover Module for Analog Signals Module and Application Description	Contains a technical description of the changeover module for use within AC 160 station redundancy configurations	D KWL 6310 97

Table 8-27. Documentation on Advant Controller 160 (Continued)

Title	Description	Article No.
89AL31 R0100 Changeover Module for Binary Signals Module and Application Description	Contains a technical description of the changeover module for use within AC 160 station redundancy configurations	D KWL 6311 97
89RT01 Redundancy Test Module Module and Application Description	Contains a technical description of the redundancy test module usable for AC 160 redundancy configurations	D KWL 6312 97
89AR30R0100 Relay Unit Module and Application Description	Contains a technical description of the relay unit usable within 2- or 3-channel protection systems using AC 160.	D KWL 6313 97
ABB Master - Installation Rules	A description on the installation rules for Advant OCS, to ensure correct function in environments where such disturbances are present.	7650 203-203
Interference-free Electronics. Design and Applications	Interference-free electronics teaches how to design circuit boards, electronic devices and systems with high immunity to interference. The book also deals with process adaptation, communication and power supply with immunity to interference.	3BSE000877R1

8.5 Discontinued Articles

Table 8-28. Discontinued Articles

Description	Consists of	Article No.
Analog selector switch 4-fold, each for 3 inputs and 1 output	89AU31 R0100	GKW N 000 347
Binary selector switch 8-fold, each for 3 inputs and 1 output	89AL31 R0100	GKW N 000 348
I/O interface cable set	—	GKW E 602 635
Redundancy test module	89RT01	GKW F 310 385
Relay unit with 6 relays, 3 of them configured as 2oo3	89AR30 R0100	GKW N 000 326 R0100

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